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"THE RAILWAY MECHANICAL MONTHLY"

(Including the Railway Age Gazette "Shop Edition.")

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CONTENTS

EDITORIALS:

Ten Dollars for a Letter.....	441
Clean and Neat Shops.....	441
Master Blacksmiths' Convention.....	441
Engine House Equipment.....	442
Traveling Engineers' Convention.....	442
New Books.....	442

COMMUNICATIONS:

Repairing Driving Boxes.....	443
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MISCELLANEOUS:

Engine House Equipment and Facilities.....	455
--	-----

ILLUSTRATED:

Master Blacksmiths' Association.....	444
Pneumatic Hammer for Smith Shop.....	454
Goodwin Duplex Water Glass.....	458
Tender Wheel Lubricator.....	459
Mikados for the Lackawanna.....	459
A Novel Design of Sling Stay.....	462
Traveling Engineers' Association.....	463
Solid End Main Rod.....	478
Link Grinding Machine.....	481
Shop Safe Guards.....	482
Boiler Tube Testing Machine.....	484
Locomotive Blowoff Valve.....	485
Sectional Tube Expander.....	485
Automatic Temperature Regulator.....	486
Coupler Yoke Shearing and Riveting Press.....	486
Combination Pattern Makers' Grinder.....	487
Attachments for Tool Room Lathes.....	488
Radial Engine and Tender Buffer.....	489
Forging Flat Wrenches.....	489

GENERAL NEWS SECTION:

Notes.....	490
Meetings and Conventions.....	492
Personals.....	492
New Shops.....	495
Supply Trade Notes.....	496
Catalogs.....	498

Ten Dollars for a Letter

In the July number of the *American Engineer* was an article on An Ideal Boiler Tube Department by L. R. Pomeroy, which showed an arrangement of equipment for handling 450 boiler tubes in one day at a labor cost of not more than three cents a tube, from engine to engine. In the August issue of this journal Walter R. Hedeman had an article on Care of Locomotive Boiler Tubes, in which he told how the tubes should be applied, maintained and renewed. The two articles thus covered the subject thoroughly. Did you find anything in these articles that has helped you to get better results? Are you using methods or tools superior to those described? Can you suggest better ways of performing the various operations? Are there other phases of the question which should have been considered? If so, write and tell us of your ideas, methods or experiences. For the best letter on any phase of this subject received before September 26, 1912, we will mail a check for \$10. Such other letters as may be accepted for publication will be paid for at our regular space rates.

Clean and Neat Shops

H. T. Bentley, assistant superintendent of motive power and machinery of the Chicago & North Western, brought out an excellent point in his address to the master blacksmiths at their recent convention. The point was to "keep the shops neat, clean and tidy, having a place for everything and keeping everything in its place." Most every foreman can realize the wisdom of these words, for what one of us but cannot do much better work if things are not scattered around carelessly and the general appearance of the shop is neat and orderly? Confusion about the shop will wear on the men's nerves, greatly interfering with their productiveness. When men say they cannot keep a blacksmith shop clean they do not fully understand the meaning of the term. While it may not be possible to go through the shops without soiling one's hands, things need not be untidy. The scrap iron can be kept in a certain place, and facilities for carting the scrap away from the forges and the hammers should be sufficient to keep the shop picked up. One laborer giving all of his time to this work would so increase the output of the workmen that his wages would be more than paid for. Foremen in railway shop departments other than the blacksmith shop would also do well to keep this matter constantly in mind.

Master Blacksmiths' Convention

The International Railway Master Blacksmiths' convention, held in Chicago, August 20-23, clearly demonstrated the value of an association made up of shop foremen. The men were enthusiastic and eager to learn of the experiences of their fellow members. The discussions at all times were lively and in many cases protracted. The president, F. F. Hoeffle, is to be congratulated upon the way in which he presided over the meetings. He was careful to see that every member had a chance to discuss each subject, and in many cases restricted the members from speaking twice on the same subject until the other members had been heard from. While the subjects were along the same lines as those considered at previous conventions, there was something new presented in practically all of them. Many of the members make investigations of their own during the year, so as to be able to talk intelligently at the conventions and give the members the benefit of their research. This feature, of course, is ideal in any convention, and each master blacksmith should continue along this line. At the present time there are special fields in the heat treatment of metals, the handling of vanadium steel in both frames and springs, and the comparatively new processes of welding, which need to be investigated. One of the best subjects considered this year was that of shop kinks. A comparison of the different ways of doing the same operation, even though the facilities at different shops are very

different, cannot help but suggest better and improved methods to the members interested in the work that is under discussion.

As H. T. Bentley said in his address, any convention that tends to bring its members together in the interests of their employers is one that should be encouraged. This association may certainly be included in that category, and the superior officers of the master blacksmiths may rest assured that their companies will benefit by having the members attend the convention, provided, of course, that these members conscientiously attend the meetings. The meetings this year were well attended, although the punctuality was not all that might have been desired.

Engine House Equipment

Mr. Cordeal's third article on efficient engine house operation appears in this issue. The first article, which considered the best type of engine house organization, was published in the May number, page 221, and the second one, on engine house reports and records, appeared in the July issue, page 339. The question of providing additional facilities, which is covered in the third article, must be treated as a cold-blooded business proposition, but to do this properly it is of vital importance that the right point of view be selected. For instance, the repairing and maintaining of locomotives is not the real business of a railway, but is incidental to the conducting of transportation, from which the revenue is derived. It is, therefore, necessary to study the question from an operating point of view, rather than that of the mechanical department. Really both viewpoints should be the same, but unfortunately too many mechanical department officers do not appreciate this as fully as they should, and strive to reduce the expenses of their department, regardless of its effect on the road as a whole. There is also the danger of erring too far on the other side as suggested by Mr. Cordeal. Each engine house must be considered by itself, for what may be good in one case would be all wrong in another. For instance, two trunk lines each have a division in the same territory on which the conditions are quite similar. One road pools its engines and uses one-third the number of locomotives to handle the same business as does the other road. Manifestly the engine house facilities on the first road must be more complete and elaborate than those on the second road, which has very much more time in which to clean and repair the locomotives and return them to service. The important thing, therefore, is to get the engines back into service as soon as they can be used, even though the mechanical department costs may be considerably increased thereby.

Traveling Engineers' Convention

The twentieth annual convention of the Traveling Engineers' Association, held in Chicago last week, fully upheld the reputation of previous meetings in attendance, interest and value. There were 492 members registered, and the total attendance, including supplymen, ladies and guests, was over 1200. Two long sessions each day were hardly sufficient to give all who desired to speak an opportunity to be heard. During the sessions there were seldom less than 200 in the meeting room, and frequently double this number. At no time was there any lagging in the interest, and often the president had to decide the claims of four or five members who wished the privilege of the floor. The time for adjournment, rather than a lack of speakers, determined the closing of a subject in nearly every case.

A spirit of this kind—and the Traveling Engineers' Association is noted in this respect—can hardly help but produce real, tangible, beneficial returns to the members who are fortunate enough to be present, as well as to railway companies that were farsighted enough to send their employees. With very few exceptions all of the more progressive railways were represented;

in one case by 23 men, in another by 19, and in many cases by from 10 to 15 men. The subjects considered were all of primary importance, and if there was any way of determining the improvement in such matters as fuel economy, train braking, feed water treatment, etc., that will result from the knowledge gained at these meetings, there is little doubt but that every railway would order every traveling engineer on its lines, that could be spared, to attend the next convention—and that they would be amply repaid.

The 1912 convention was particularly fortunate in the selection of the men who were invited to deliver addresses and profited by four valuable papers that were not listed on the program. These were by S. O. Dunn, editor of the *Railway Age Gazette*, who clearly pointed out the opportunities of the traveling engineer in improving the efficiency of labor; J. M. Daly, general superintendent of transportation of the Illinois Central, who explained the best practices of tonnage rating; H. T. Bentley, assistant superintendent of motive power of the Chicago & North Western, who pointed out the duties of the members in the safety campaign, smokeless firing, and in co-operation; and B. A. Worthington, president of the Chicago & Alton, who indicated the duty of all to neutralize the misleading socialistic ideas that are being adopted by the thoughtless or ignorant. A liberal extract of each of these addresses will be found elsewhere in this issue.

The traveling engineer, more than any other officer, links the mechanical and the operating departments together, and in the discussions the subjects were often, very properly, considered more from the operating than the strictly mechanical point of view. The discussion on the braking of long trains was an example of this. The consideration of this report occupied two full sessions and was practically all confined to the effect of different methods of handling the engineer's brake valve on the long passenger and freight trains that are now being operated, and the interest in the latest apparatus was centered in its effect on the train. It is quite evident that the progress in mechanical devices for railways is advancing more rapidly than the training of men to properly handle them, and it is encouraging to see this association show a strong tendency to give its greater efforts in this direction.

The desire of the members to obtain the maximum amount of information in the time allowed was indicated by the number of representatives of supply companies who were given the privilege of the floor and requested to answer questions. In this way expert advice of great value was very frequently obtained.

NEW BOOKS

Methods of Analyzing Coal and Coke.—Technical paper No. 8. Written by Frederick M. Stanton and Arno C. Fieldner. Published by the Bureau of Mines, Washington, D. C.

This paper describes the methods used at the laboratories of the Bureau of Mines for analyzing coal and coke and determining the heat value of these fuels. The original methods which were recommended by the American Chemical Society, together with such modifications and changes as have been deemed advisable, are included in the paper. Copies may be obtained by writing to the director of the Bureau of Mines, Washington, D. C.

Railroad Operating Costs. By Suffern & Son. Bound in cloth, 144 pages, 8 in. x 10½ in. Published by Suffern & Son, New York. Price \$2.

To those who are compelled to use the statistics of railways, it has been evident that the matter published in the annual report of the Interstate Commerce Commission left much to be desired. The reports furnished by the railways, however, include vastly more than is given general circulation, and about a year ago Suffern & Son, accountants, New York, published the first edition

of, "Railroad Operating Costs," in which was included much statistical matter that had not previously been available. This book met with so much success that a second edition is now being issued. This includes later reports, covers a greater number of railway systems, and has been extended and amplified in other directions. For example, the subject of maintenance of equipment is now treated in four chapters instead of one, as in the first volume. There is also an entirely new chapter on fuel costs, which contains much original information on this highly important subject. The volume has been arranged to include the operations of the year 1911.

The Modern Locomotive. By C. Edgar Allen. 175 pages, 4¾ in. x 6½ in. Flexible cloth. University Press, Cambridge, England; for sale by G. P. Putnam's Sons, New York. Price 40 cents.

The treatment of the modern locomotive in this little volume is confined almost entirely to European practice, and it relates largely to locomotive performance rather than to its design and construction. The author has succeeded in presenting an interesting and authoritative account of locomotive performance, although it is necessarily limited and concise. It is not intended for the specialist, but rather for that numerous class which has some knowledge of mechanics and science, and finds the locomotive an interesting machine. To such readers the work is admirably adapted. After a brief account of the development of the British locomotive, considerable space is devoted to combustion, steam generation, superheating, compounding, boiler improvements and the utilization of steam. There is an excellent chapter on counter-balancing and stability, and one on performance and speed. Though the price of the volume is only 40 cents, it contains more information on the locomotive than many of the popular treatises published in this country which are larger and cost several times as much.

Forney's Catechism of the Locomotive. Part II, Third edition, revised and enlarged. By George L. Fowler, consulting mechanical engineer. Bound in cloth, 6 in. x 9 in., 287 pages, 195 illustrations. Published by the Simmons-Boardman Publishing Company. Distributed by the McGraw-Hill Book Company, 239 West 39th street, New York. Price \$3.

In Part I of the third revised edition there will be found a general description of the construction and methods of operation of the locomotive. In that section the machine is regarded from a purely physical standpoint and scientific discussions of the observed phenomena have been avoided. In Part II, which is now ready for distribution, the more technical features have been collected, and here will be found the discussions of the reasons for the observed phenomena. This volume aims to show the reader in simple language, and to avoid as far as possible mathematical calculations, why locomotives are built as they are and the principles of their operation. While much of the text is a discussion of principles and remains unchanged from the first edition, the later experiments and more thorough knowledge, together with the introduction of the improved apparatus, has required the addition of much entirely original matter. In this volume will be found a discussion of the principles and their application, of the expansive action of steam, the movement of the piston and rods, the design of locomotive boilers and of all types of valve gear, the resistance of trains, the proportions of locomotives, etc. All of these discussions are in the simplest of language, the value of brevity being fully appreciated by the author.

Valves, Valve Gears and Valve Designs. By Franklin DeR. Fuiman, M. E., professor of machine design at the Stevens Institute of Technology, Hoboken, N. J. 152 illustrations. Cloth, 8 in. x 10 in., 130 pages. Price, \$3.50.

A paragraph in the preface indicates that this book is a small edition published privately by the author with the expectation of printing later a more complete treatise in better form.

It is a collection of notes for use in the class room, arranged to fit in with the general course in mechanical engineering at Stevens Institute. This feature is too strongly emphasized to make the book a satisfactory one for the general use of young engineers. As a guide to the student in designing valves and laying out valve gear, it may be regarded as a good general treatment in compact shape, orderly arranged and well indexed. The section relating to piston valves and the Walschaert valve gear as used on the locomotives is too brief to make the book of value in the locomotive drafting room. The most useful portion in this respect is the condensed arrangement of the Auchinclos' method of design of the Stephenson link motion. The illustrations are uneven and often crude, and the technique of the drawing is poor. The student should have set before him the best examples of good technique in mechanical drawing, if he would obtain proper ideas in regard to correct appearance as well as correct proportion in machine design. In another edition this feature of the book should have considerable improvement, with the use of uniform sections and lettering, and a higher standard for the general finish of the drawings.

REPAIRING DRIVING BOXES

WINNIPEG, Man., July 22, 1912.

TO THE EDITOR OF THE AMERICAN ENGINEER:

Replying to Mr. LeCompte's criticism on our methods of repairing driving boxes, I do not consider the methods described by him as any more accurate than our own. The only essential difference is that while we make our boxes standard to the original back face, Mr. LeCompte makes them standard to the inside of the shoe and wedge flange. The trouble of engines failing to tram is unknown to us as each box is standard and the wheel centers are standardized at each shopping.

The accuracy of our method will be clearly seen from the following outline: The back face of the box (the inside surface that has no wear) is used in setting up for planing. Lines are scribed on the box equi-distant from the center line, and to these, by means of a "U" shaped gage the shoe and wedge channels are planed. In boring, the box is set on a parallel strip on one shoe and wedge face, with the original unworn side of the box clamped to an angle plate at right angles to the table. This assures the box being bored true with the back, as well as parallel with the face of the shoe and wedge channels.

In connection with the claimed inaccuracy in our method of applying the babbit end play liner; I do not claim that we get a face as close-grained and perfect as a machined face, but the face is practically flat and is square with the inside flanges of the shoe and wedge fit. We place the box in a vertical position and then adjust the jig-plate until the distance between its face and the box corresponds to the thickness of babbit required. The jig plate is exactly 1 in. thick, and by adding 1 in. to the required dimension we can caliper from the shoe and wedge fit to the outside face of the plate, also from the face of the plate to the back face of the box. We have not found 5 per cent. of our boxes in which the difference (in comparing these measurements) amounted to 1/32 in. Comparing the foregoing with Mr. LeCompte's methods which require the liner to be faced, I do not think this extra operation is warranted. In the majority of shops, where the liner is faced it is done during the boring operation.

E. T. SPIDY.

[In response to the invitation for criticisms of the methods described by E. T. Spidy in his prize winning article on Repairs to Driving Boxes, published in the June issue, John V. LeCompte, foreman, Mt. Clair shops, Baltimore & Ohio, submitted a criticism which was published on page 334 of the July issue. In answer to this we have received the above letter from Mr. Spidy.—EDITOR.]

MASTER BLACKSMITHS' ASSOCIATION

Program Included Papers on High Speed Steel, Case Hardening, Dies and Formers, and Shop Kinks.

The twentieth annual convention of the International Railroad Master Blacksmiths' Association was held in the Hotel Sherman, Chicago, Ill., August 20-22. F. F. Hoeffle, of the Louisville & Nashville, presided. Geo. W. Kelley, of the Central Railroad of New Jersey, an ex-president of the association, made the opening prayer. Leon Hornstein, assistant corporation counsel of Chicago, welcomed the Association in behalf of Mayor Harrison.

The secretary-treasurer's report showed a total membership of 337 and a cash balance of \$362.66 on August 1, 1912.

PRESIDENT HOEFFLE'S ADDRESS

The president made special mention of the work of the committees and spoke, in part, as follows: The opportunity for the members to take part in the convention exercises gives them a valuable educational experience and enables each to measure himself alongside of others of his craft. We are not here as individuals, but as representatives of the railways for the purpose of devising ways and means of making improvements and advancements in our field. The best minds in the world today are men who make individual efforts to improve their efficiency by constantly studying and reading good literature bearing on their work. We should constantly improve ourselves for it is important that the master blacksmith should be able to handle with credit any work that he may be called upon to do. To become expert, we must learn to realize these conditions and to qualify ourselves to meet them. Great changes have taken place in the blacksmith department by the introduction of improved methods and devices which have greatly reduced the cost of making forgings. It is necessary for the master smith to keep pace with these new mechanical and operative conditions.

There is no place in the industrial work shop, where more hard work, closer calculation and keener insight are required than in the forge and blacksmith shop. There is no class of men who watch the work more closely in the operation of their departments than the master blacksmith, in order to insure the safety of the public which depends on its thoroughness. As improved ideas are brought forth, we must accept them and when necessary, shake off the old methods and habits.

H. T. BENTLEY'S ADDRESS

H. T. Bentley, assistant superintendent of motor power and machinery of the Chicago & North Western, said in part: The blacksmith shop is one of the most important parts of a railway shop plant for when it falls down it ties up the other departments. On a recent trip to England one thing that greatly impressed me was a drop forge shop. It contained about fifty hammers, and there was not anything from a watch spring to an anchor, but what they made under the drop forge, and the work was magnificent. After it came from the drop forge nothing more was required to finish it. The trouble with us is that we leave too much stock for the machinist to take off. They say: "When we finish it, it is done."

Everybody who is working for a railway is working for the purpose of helping it pay dividends and keep the public satisfied. It would not keep you or me five minutes unless we were earning money for the company. It could not afford to do so. Therefore, every man should try to reduce the cost of the various operations that are performed by him. I believe if you will look into the question of drop forgings it will enable you to make some strides in reducing costs.

I have been through a number of blacksmith shops and many of them look untidy. The foreman will say: "You cannot keep a clean blacksmith shop." A blacksmith shop has no more need

to be dirty and filthy than any other place around a locomotive plant. I have been in a blacksmith shop where I could eat my dinner off of the floor, it was so clean. Tidiness is something we ought to practice. Have a place for everything and put it in its place. When a visitor comes in, he does not have time to see how many forgings you are making but the clean shop makes a favorable impression.

The hydraulic forging machine has impressed me favorably and I think there is a great field for it.

FLUE WELDING

J. P. Kane (B. & O., Newark, Ohio): Flue welding should be done in the blacksmith shop. In our shop the flues are cleaned by a rattler 28 ft. long, running at 15 r. p. m., which will clean 200 flues in two hours when water and small pieces of iron are used to loosen the scale. The flues are then dumped near a cutting-off machine, on which the first cut is made at an angle of 45 degs. Afterwards they are placed near a crude oil furnace of our own designs having 3 heating holes. A good welding heat is obtained in 48 seconds and the flues are expanded and the safe-ends welded and shouldered in one heat. Both operations are performed by one man on a machine having a shoulder attachment, at the rate of 40 flues per hour. The flues are then cut to length and expanded for the front end of the boiler on an especially constructed machine which performs the work quickly. Each flue is tested under 400 lbs. per sq. in. hydrostatic pressure. By doing so the number of flues removed from the boiler after the pressure has been put on is about one-fifth of one per cent.

Discussion—J. Masser (C. N. O. & T. P., Ludlow, Ky.):—We welded 60 superheater flues in 7 hours on a hard swedge with a blacksmith and 2 helpers using a coke furnace for the heating. I believe that a blacksmith should do the work, not a boilermaker.

G. H. Judy (Pittsburgh, Pa.):—In the past the blacksmith has been doing the flue welding but the man who puts them in the boiler ought to be responsible.

F. F. Hoeffle (L. & N., Louisville, Tenn.):—On our road the flue welding is done in the boiler shop, but recently a 5½ in. superheater tube was brought to the smith shop for welding. This we did on a 4 in. forging machine with perfect success.

G. W. Kelly (C. R. R. of N. J., Elizabethport, N. J.):—We use a handy man for welding flues but he was carefully instructed how to do the work by a mechanic, as are all the other handy men we use on machines.

A. McDougal (B. & A., Milo, Me.):—We use a hammer for welding flues and work the flue back and forth so that the metal on both sides of the weld will be thoroughly hammered; by doing this we have no trouble of breakage just back of the weld.

CARBON AND HIGH SPEED STEELS

F. Kopenhoefer (C. N. O. & T. P., Ferguson, Ky.):—For high speed steel the weight of the hammer and the force of the blows should be varied for the size of tool to be forged. As this steel is more dense than carbon steel it should never be worked at too low a heat and should frequently be reheated, keeping it as near a bright red as possible. When the tool is forged, and while it is still red hot, it may be easily ground on a dry emery wheel. It should then be reheated to a red heat and be allowed to cool in a dry place to eliminate all forging strains. The tool should then be heated slowly to a good red heat and the point to a good sweating heat. Then plunge in oil or harden in air. One essential is a clean fire, and the blast should not touch the steel while heating it to harden.

All carbon steel tools should be hardened as uniformly and at

as low a temperature as possible. It is better for a tool to be hardened at too low a heat than to be so brittle and hard that it has to be softened by tempering. Do not heat to a distinct line for hardening; also avoid dipping to a distinct line on tools not to be hardened all over, such as reamers, drills, taps, etc. All tools whether made on an anvil or by machine should be free from scratch marks, as they are starting points for cracks or breaks when hardening.

W. J. Coward (Erie, Kent, Ohio):—We use compressed air and oil for hardening and believe that the best results may be obtained by strictly following the makers' directions. For lathe and planer tools the air seems to be best. When annealing high speed steel we heat it to a bright red and cover it over with charcoal and give soft coal in a fire—and leave it to cool.

W. F. Stanton (J. A. Fay & Egan Company, Cincinnati, O.):—We use the best grade of carbon steel for reamers, rose bits, milling cutters, lathes, tools, planer tools, matcher bits, dovetail bits, router bits, and planer knives. Carbon steel should be heated in a clean fire, and kept above the tuyre iron, as the steel coming in contact with the air will burn, making it unfit for use. After the tools have been forged we re-heat them and let them cool off before hardening. Treating carbon steel tools in this manner relieves the strain, and, when hardened, they are less liable to crack.

In hardening carbon steel for woodworking machines, all the pieces are cooled off in oil, and drawn to a certain color depending on the shape and the kind of work they are to be used for. We find the lead bath the best for fine-edge cutting tools. In annealing we use charcoal, mica, burnt bone, and iron turnings packed in air tight boxes and heat in an oven and leave to cool slowly. Too much annealing is worse than not enough. Steel that is over-annealed opens the pores and makes the grain coarse, and if not worked over again will show hard and soft spots on hardening.

The method of hardening high speed steel depends entirely on the purpose for which it is used, but it should be remembered that any tool that is to be subjected to a high heat while working can be properly hardened in one way only, and that is by heating it to a white or sweating heat, or from 2150 deg. to 2200 deg. F., and cooling as rapidly as possible by dipping that part of the tool which is to be hardened into some good thin oil. Lathe and planer tools for all general purposes should be preheated slowly to a bright cherry red, bringing the point rapidly to a white or sweating heat, and then plunge into a tank of fish or cottonseed oil, keeping them in motion until cool. For tools that are to be used in cutting cast iron or anything containing sand or scale, better results will be obtained by cooling in a solution of kerosene in which has been dissolved about 10 per cent. of cyanide of potassium, and 10 per cent. of common salt. Where tools of this kind have been forged to shape, it is good practice to re-heat the tool to a bright cherry red after forging and allow it to cool slowly in a box of sand or lime, after which re-heat and harden in the regular way.

For general purposes a semi-muffle furnace burning gas is the most desirable for treating high speed steel. When large quantities are being hardened continually, the barium chloride furnace is the best to use as it protects the steel from coming in direct contact with the blast, thus eliminating danger of oxidization. In placing tools in barium they should be first preheated to about 1300 deg. F. to eliminate the shock occasioned by subjecting the cold metal to the intense heat suddenly.

Discussion—C. Watson (Ill. Steel Co., Chicago, Ill.):—An instrument, such as a pyrometer, should be used to determine the temperature when tempering steel. We take a sample of every bar of steel and get its critical point. This is recorded and all tools made from the bar are given the proper treatment. We find the only proper way to draw the temper of a tool again is in an oil bath. We have tried lead and everything else, but find oil gives the best results. We have a table of temperatures indicating the degs. Fahr. the oil bath should be kept at to temper to a blue or

a straw. With this arrangement any irregular shaped piece can be tempered uniformly, if left in the oil long enough. When judging temperatures with the naked eye there will be a variation of 200 or 300 degs., which makes it impossible to give the steel the proper treatment. At the South works we rolled a lot of manganese rails and the hardness of the web was so great we could not drill a 3/16 in. hole. We tried to burn it through with oxy-acetylene and electricity, and we got steel punches and tried them but it was not until we had given the punches a proper heat treatment that we could do anything, and then we punched 2,000 holes in the rails with four punches.

H. Timmons (Am. Loco. Co., Richmond, Va.):—When tempering long articles, such as taps and reamers, they will probably be bent, if there are hard and soft parts. Care should be taken to heat and cool the tools uniformly.

T. E. Williams (C. & N. W., Chicago, Ill.):—If the ingot from which a tool is made was hammered before it was thoroughly heated, it would cause the tool to bend while being tempered.

C. F. Hinkens (Westinghouse Air Brake Co., Wilmerding, Pa.):—Where pyrometers are used they should be set level and plumb, for if they are not they will be liable to vary as much as 100 deg.

George Hutton (N. Y. C. W., Albany, N. Y.):—Assuming that taps are made of carbon steel, there is not a factory that can make 12 taps and guarantee that they will come out straight. You get them in the annealed bar and machine them. Some want to put them in a furnace right off, but if they are preheated properly, they will be more liable to come out straight. If a pyrometer is placed in a furnace that is not muffled it will not register the correct temperature of the material being heated on account of the variation due to drafts. In my experience taps and reamers of high speed steel are much easier heat treated than the carbon steel tools. With carbon steel there is danger of not getting them hot enough, and the high speed steel has much less chance of being destroyed in the treating than carbon steel.

C. W. Schafer (C. of Ga., Macon, Ga.):—A pyrometer may be checked with common salt which melts at about 1,465 deg. F. If any foreign element sticks to a tap or reamer while it is being cooled, so that the cooling material does not reach the tool, the spot it covers is liable to be soft. The best way to heat a tap or reamer is in an electric furnace.

DROP FORGINGS

H. E. Gamble (P. R. R., Altoona, Pa.):—The dies on the drop forging machines must be designed so that the work may be readily lifted from them after each blow of the hammer. Also there should be enough, but not too much, metal to completely fill the die. With these suggestions followed the dies will give good service. Sometimes the dies will last until re-dressing wears them out, and again they will not last nearly as long. This is sometimes attributed to the operator not having his material properly heated, his dies not lined up, or the work not of the proper size. In our shop we use carbon, vanadium, Bessemer and crucible steels; in some cases we case-harden the faces, while in others we heat from 1,480 deg. to 1,500 deg. F., cooling the face and drawing it to 900 deg. F. We do not harden the tongue of the die. Be sure that the work is properly heated and strike as few blows as possible with the hammer; the first blow does the most work.

John Cunningham (Union High School, Grand Rapids, Mich.):—Oil furnaces are almost universally used for heating, but in some cases large coal furnaces of the reverberatory type are used with a steam blast, the object being to prevent oxidation of the metal. The steam blast has also been used in oil furnaces with success. Concerning the materials and life of drop forging dies, *Machinery* tells us that forged blocks of open hearth steel should be used for this work, as the cast steel blocks are liable

to have flaws or blow holes that will interfere with the making of a good die. A rough estimate of the life of a drop forging die used for medium sized work on Bessemer steel was given by a foreman of long experience as about 40,000 pieces.

Gray iron castings may be used successfully for certain classes of light forgings where the impressions are not too deep, or definite, and there are not many articles to be made. They are much cheaper, and as the impression can be molded in the die but little machine work is necessary. Considerable work can be done with them if they are carefully designed and kept properly adjusted.

CASE HARDENING

William Nicholson (C. P. R., Montreal, Can.):—Case-hardening results are dependent wholly upon the character of the metal, the carbonizing material, the temperature of the furnace, length of time the work is subjected to the carbonizing heat, and the heat treatment following the carbonizing process. The work to be case-hardened at the Angus shops is packed in bone black with a covering of about $\frac{1}{4}$ in. of the same material and the pieces are separated by scrap leather. This will require about $6\frac{1}{2}$ hours of heating from the cold furnace, and we have always had good results.

G. Creeden (B. & A., Springfield, Mass.):—We have one annealing Ferguson furnace, 72 in. x 30 in. x 28 in., where we do all case-hardening and annealing. We use cast iron boxes and pack the steel in charcoal. The boxes are placed in the furnace in the morning and heated to about 1,500 deg. F. for about 9 hours. The furnace is shut down at night and the

paraffin oil and 25 gal. of lard oil with 2 bushels of fine table salt. There is a $\frac{1}{2}$ in. pipe at the bottom of the tank with $\frac{1}{16}$ in. holes 6 in. apart, through which air is blown before dipping the cutters, so as to thoroughly mix up the entire contents. After the air is shut off and the oil has settled, put the cutters in and move them about until cool.

Discussion—F. F. Hoeffle (L. & N., Louisville, Ky.):—We use a liquid potash of $2\frac{1}{2}$ parts bichromate of potash, 5 parts Prussic potash and 10 parts of salt, which gives good results.

G. Lindsay (E. & T. H., Evansville, Ind.):—We have discontinued using the combination mentioned by Mr. Hoeffle, as it left a rough surface on the work. I do not believe it is necessary to case-harden as deeply as we do, for we never wear all the way through the skin. Four hours is plenty.

Geo Hutton (N. Y. C., W. Albany, N. Y.):—We use a com-

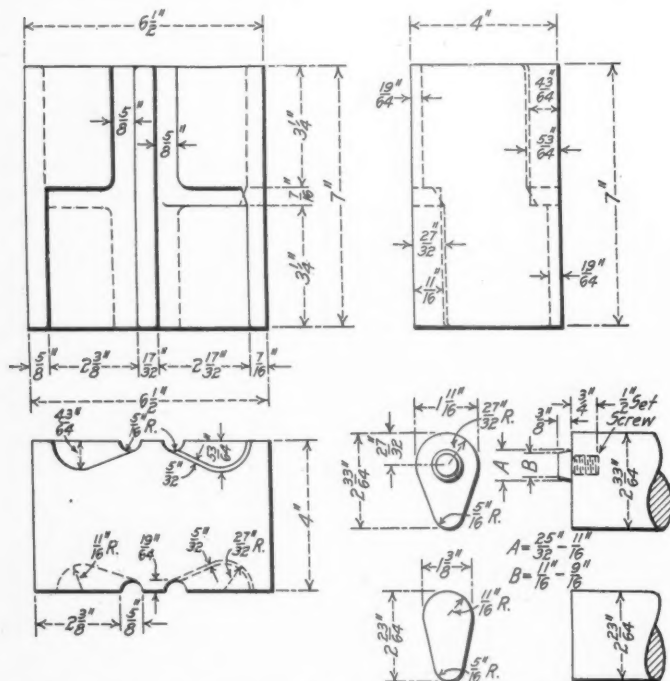


Fig. 1—Dies for Forming Ends of Grab Irons; Lehigh Valley.

boxes remain in them until the next morning. They are then taken out and cooled on the floor. This will give a good annealing without a scale on the material.

We heat our long carbon steel reamers in a lead pot to 1,500 deg. F., and quench them in salt water. We draw them in hot oil to 373 deg. F. We treat all carbon steel in this manner, varying the temperatures according to the class of work to be done.

When hardening high-speed steel cutters we place them in an open oil muffle furnace and bring them to a cherry red. They are then placed in a lead pot at about 1,950 to 2,000 deg. F., for about two or three minutes, which will give them an even heat. Then dip in an oil bath, made up of 25 gal. of

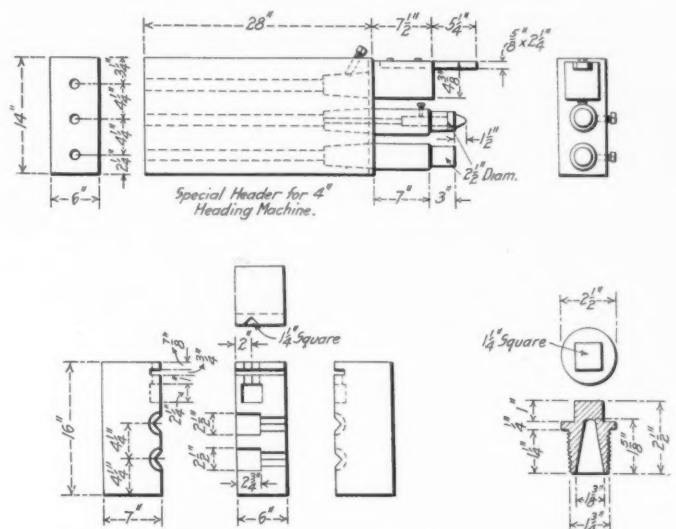


Fig. 2—Forging Machine Dies for Making Grease Plugs; Boston & Albany.

pound made of cyanide and salt that takes only 3 hours to case-harden, and although it is not $\frac{1}{16}$ in. deep, it is enough.

J. T. McSweeney (B. & O., Baltimore, Md.):—Saltpeter is the quickest thing to case-harden with.

H. E. Gamble (P. R. R., Altoona, Pa.):—We are still using from 3 to 14 hours for case-hardening; it depends largely on the bulk to be hardened. We are not using bone, but find that a salt and soda mixture is giving good results.

T. E. Williams (C. & N. W., Chicago, Ill.):—We use granulated bone in our case-hardening altogether. We have tried out several compounds, and have not had the success that we have had with bone. We charge our box at night, and the night watchman takes care of it.

FORGING MACHINES, DIES AND FORMERS

W. Stock (M. C., Jackson, Mich.):—It is not a question of how many dies a man develops, but how useful they are. Not how much a certain die reduces the cost of a certain forging, but how much actual money is saved each week or month by this or that particular die. You may have a die that shows a saving of 150 per cent. on one forging and yet it may not save your company \$10 a month. On the other hand you may have one that only shows a saving of 5 per cent. and at the same time makes a monthly saving of \$50. A foreman blacksmith should never be satisfied until he has developed dies enough to keep his machines going all the time. Forgings made with the proper dies do not have as much excess material to be machined off as hand forged work, resulting in a considerable saving in labor cost as well as in the cost of the material.

J. W. Riley (L. V., Sayre, Pa.):—The Lehigh Valley is making 1,500,000 grab irons to comply with the safety appliance

requirements. With the dies shown in Fig. 1, we can turn out 4,000 ends in 9 hours on a 1½-in. forging machine. It requires one heat and two blows to make each end. The header used for the second blow is provided with a projection that almost punches a hole through the end. With this it is estimated that 350 ft. of 1 in. round iron is saved a day. When heading the second end, the first one is placed on a button which holds the iron in line, so that when bending it no twisting is necessary. After the ends are formed they are trimmed, when necessary, and punched on a hammer fitted up for that purpose, a shear

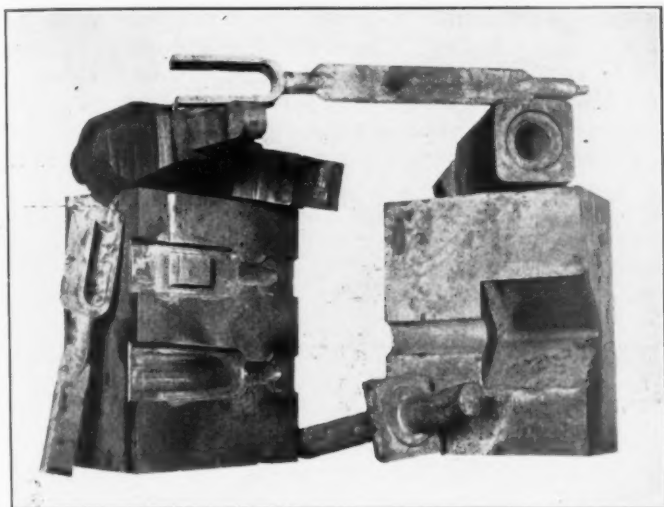


Fig. 3—Dies for Trailer Spring Hanger and Trailer Hanger; Chicago & North Western.

blade being placed in the top hammer holder and a punch in the header holder. Six thousand ends can be trimmed and punched in 9 hours. They are bent cold on a power punch, which makes a bend at every stroke of the machine. The dies are made of carbon steel and 60,000 grab irons have been made on one set of dies without dressing. The headers are made of piston rod steel which is hardened about like carbon steel. They require dressing quite often.

G. Creedon (B. & A., West Springfield, Mass.):—Dies used on a 4-in. forging machine for making grease plugs for side rods are shown in Fig. 2. The plugs are made from 1¼-in.

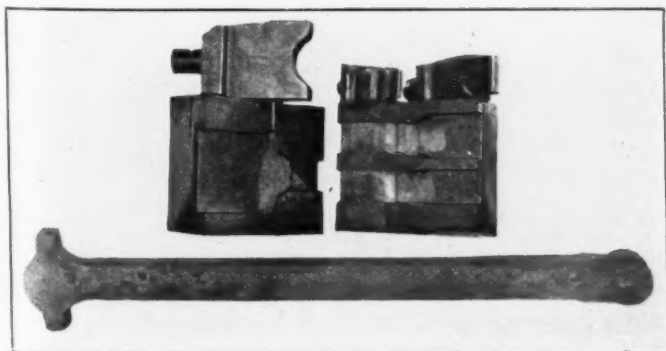


Fig. 4—Dies for Forming Back Section of Side Rod; Chicago & North Western.

square iron and the three operations are made with one heat. The first stroke upsets the rod, the second punches it and the third cuts it off to the required length. The plugs have proved very satisfactory and do not rattle off.

T. E. Williams (C. & N. W., Chicago, Ill.):—Dies for our large machines are nearly all made of cast iron. Those subjected to severe wear have steel inserts hammered from old driving axles. The small dies are nearly all made of cast steel, with tool steel inserts put in where necessary. We made 140

equalizers for way-cars from common bar iron 2 in. x 3 in., bending them on a bulldozer and upsetting them on a forging machine, for a total cost of \$110. If these were hammered from old axles, bent and finished at a fire, the cost would have been at least \$700. Allowing \$150 for material and labor on the dies, this leaves a saving of \$440.

Fig. 3 shows a front trailer spring hanger made on a 6-in. Ajax forging machine. This seems to be a very small forging for such a large machine, but as it requires about 14 ins. of plunger travel to make the weld, it cannot be made on a small machine. It costs about \$4.75 apiece to make them by hand; we are now making them on the machine for 85 cents each. The second forging in Fig. 3 is a trailer hanger. This piece is 3 ins. round with an 8 in. x 8 in. x 1¼ in. collar which is upset in two strokes in a single groove die. To make this by hand, it would have to be forged from the solid rod.

Fig. 4 shows the dies and plungers for making the back section of a locomotive side rod. We have several of these side rods in service, and some of them have come to the blacksmith shop to be straightened after having been badly twisted up in a wreck; they showed no fracture, proving that they were well made. Fig. 5 illustrates the dies and plunger used for forming the forked end of a main rod.

George W. Kelly (C. R. R. of N. J., Elizabethport, N. J.):—We have a 5-in. universal Ajax machine, driven through gears by a 40 h. p. motor, and a 3½-in. machine equipped with the automatic control made by the Monitor Controller Company. The machine is started by simply pushing a button attached

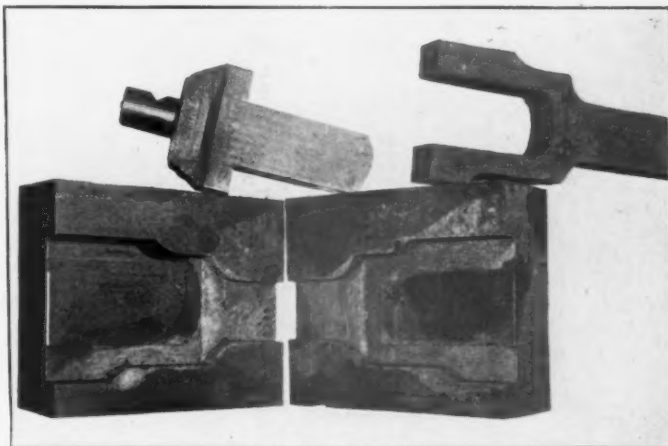


Fig. 5—Dies for Forming Forked End of Main Rod; Chicago & North Western.

near the clutch of the locking lever. This energizes a series of relays in the controller box on the wall, which are so adjusted that the current fed to the motor will not overload the circuit and damage the motor. The system is so regulated that the machine will ordinarily attain full speed in about six seconds from the time the button is pushed. It is stopped by pushing another button. This system saves time for the operator, as there are no belts to shift, no switches to pull, and no rheostat to fool with. There is a saving of electricity, as the machine will more likely be stopped when not working; a saving in the life of the motor and perhaps in the wrecking of the machine. The machine may be "inched" along as readily as before and the system on the whole has proved satisfactory.

A. W. McCaslin (P. & L. E., Pittsburgh, Pa.):—A collection of forgings that are made in the Pittsburgh & Lake Erie shops are shown in Fig. 6.

SPRING MAKING

H. D. Wright (C. C. C. & St. L., Beech Grove, Ind.):—When repairing springs measure them up and see that you have the same amount of steel in pounds and in inches as when the

spring was new, and if not, add plates until you get it. By using our rules and scales a little more, we can save many a dollar that is thrown away in the scrap. I have made a test on a spring plate to find out its condition after twenty times resetting and tempering. The plate was $\frac{3}{8}$ in. x $3\frac{1}{2}$ in. x $22\frac{1}{2}$ in., and weighed 8 lbs. $8\frac{1}{2}$ ozs. After being set and tempered once, it had lost $\frac{1}{2}$ oz., making the plate weigh 8 lbs. 8 ozs. After twenty times setting and tempering it had lost 1 lb. $8\frac{1}{2}$ ozs., making the plate weigh 7 lbs., a reduction of 18 per cent. The analysis of the steel before and after treating is given in the following table:

	Before.	After.
Phosphorus	0.05 per cent.	0.05 per cent.
Sulphur	0.033 per cent.	0.038 per cent.
Manganese	0.26 per cent.	0.23 per cent.
Carbon	0.55 per cent.	0.50 per cent.

This shows a difference that has not improved the material any. In treating vanadium spring steel, heat it to about 1400 degs. F. and set just the same as any other steel; then dip in oil

foreman should know the degree of heat at which the different lots of steel should be worked to the best advantage, and the amount of flashing required to bring the steel to the proper temper; each test piece should be given a pressure test, so as to determine the load the spring will carry. A spring plant should be so laid out that there will be no backward movement of the work.

John Holl (C. C. C. & St. L., Delaware, Ohio):—I have noticed that the spring leaves that were dipped in cold oil will not give as good service as those dipped in warm oil.

O. D. Vawter (Wabash, Moberly, Mo.):—When handling repaired springs we use as much of the old material as possible and if the set is all right with the exception of a few broken plates we simply add new plates without resetting the spring. We allow the first and second plates to stand off 5-16 in. to $\frac{1}{2}$ in. and give the plates a gradual taper to the top.

J. Carruthers (D. M. & N., Proctor, Minn.):—We have re-

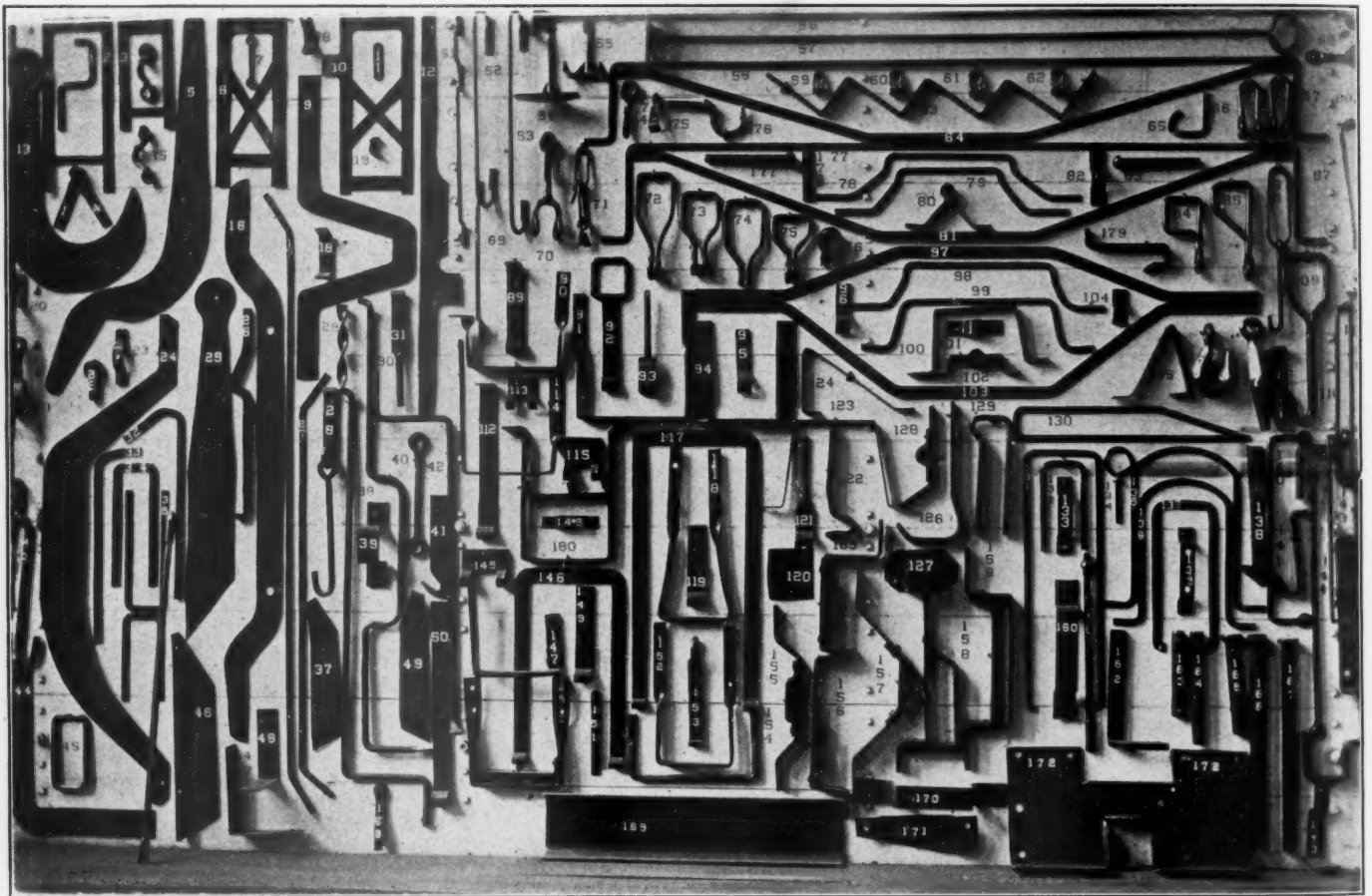


Fig. 6—Examples of Forgings Made at the Pittsburgh & Lake Erie Shops at McKees Rocks, Pa.

and let it stay until cold, then draw back until the scales shed freely—a little more freely than they do on ordinary carbon steel.

G. P. White (P. M., Saginaw, Mich.):—There should be one main spring plant for the system located at the same point as the general storehouse. All springs should be handled through the store department for the following reasons:

First, we all have some difficulty in keeping the stock of steel on hand for making repairs. If the responsibility of keeping all points supplied with springs fell on the store department, it would make more of an effort to keep the material for repairs on hand.

Second, the cost of repairs would be kept more accurately as the springs would all be repaired on monthly store orders.

Nothing but the best of steel should go into a spring, as the life of the locomotive depends a great deal on the springs. The

cently applied some vanadium steel spring to our engines as an experiment. I straightened out one of the plates a number of times in an air press the same as I would any other and it lost 1-16 in. of its set. A $\frac{3}{4}$ -in. block was then placed in the center of the plate and the plate was bent that much beyond its straightened position and it was found that it lost $\frac{1}{8}$ in. of its set. We treated this steel the same as we did the ordinary spring steel.

FRAME REPAIRING

Geo. Hutton (N. Y. C. & H. R., West Albany, N. Y.):—We have changed the frame from a spliced front end to a solid frame throughout on some of our engines, forging the solid front ends from scrap with oil welds in most every case with good results. The welded portion is always made larger than the section of the frame. On new engines the frames come from

the manufacturer properly annealed and in my opinion we should not anneal the pedestals and braces every time the engine is shipped. Some recommend annealing other parts of the frame after an oil weld has been made, so as to relieve the strain. I believe this does the frame more harm than good. Experts have tested frames that have run 3 years without annealing and have found no change in the structure of the material. The frame, if properly annealed, will stay in that condition as long as the life of the engine, except, perhaps, when it has had numerous welds. In that case the whole frame should be annealed in a furnace large enough to handle it.

F. Norris (Sheffield Car Works, Three Rivers, Mich.)—The thermit process is the best for repairing frames while they are in place on the engine, as the welds are made with steel and can be made stronger than ordinary welds by making the section larger than the frame itself. When repairing the frames in the smith shop too great care cannot be taken to see that the frame is not overheated. Whenever possible the welding should be done under the steam hammer and the frame hit as hard as practicable. It requires more force to weld steel than iron on account of its being harder and the light blows will not affect much more than the surface.

C. V. Landrum (N. C. & St. L., Nashville, Tenn.)—A successful method of repairing frames that are broken in the bottom rail close to the jaw is shown in Fig. 7. We cut the rail

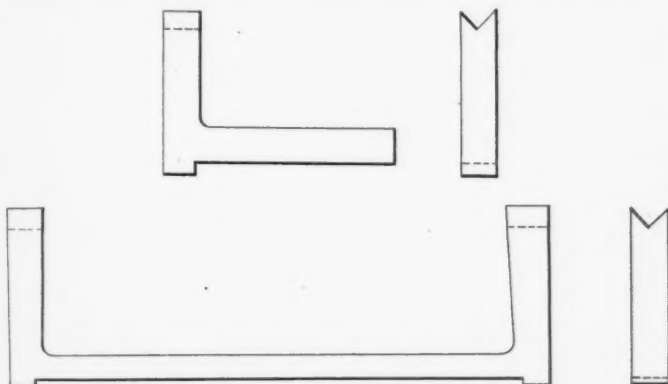


Fig. 7—Method of Repairing Frame Breaks in the Lower Bar Near Pedestal.

about 10 in. or 12 in. from the jaw and cut the jaw about 4 or 5 in. above the rail and weld with oil. If the bottom rail is broken near both jaws we weld in a piece connecting the two pedestals.

J. W. Smith (I. C., Paducah, Ky.)—I have never made new frames complete, but have made half of them and use old driving axles with good results. We weld the frames with thermit. I believe that cast steel frames after they are made ought to be annealed in a suitable furnace and be allowed to cool off slowly with the furnace.

F. F. Hoeffle (L. & N., Louisville, Ky.)—I have had considerable experience in welding frames with oil and thermit and am a clean cut thermit man. The only objection to this type of weld is that it leaves the frame bulky at the joint. We have made 24 of these welds during the past year, and they have all been successful.

O. D. Vawter (Wabash, Moberly, Mo.)—In making an oil weld on a 4 in. steel or iron frame, we spread the frame and build a furnace around it. A depression is rammed in on each side of the frame while at a welding heat, with round pein rams and wedges that are heated in the same furnace are welded in on each side of the frame. An oil burner is used on each side, unless the break is under the firebox. In that case a machinist cuts a V-shape piece out on each side of frame and the weld is made the same as on an anvil. On large 6 in. cast steel frames we use several small wedges and weld the same as on the anvil. I find

one wedge on each side cannot be rammed hard enough to weld the center of frame.

S. Uren (Sacramento, Cal.)—A rapid change in temperature has as much to do with frame breakage as anything else. In the Sacramento valley an engine starts out with the temperature at perhaps 50, 60 or 75 deg.; it goes 75 miles and gets into snow banks. The lower braces dragging through the snow are contracted while the upper portion of the frame, next to the boiler, is expanded.

H. D. Wright (C. C. C. & St. L., Beech Grove, Ind.)—I have found that the cast steel frame gives trouble where the risers are placed when casting. The question has been asked time and time again: "Why doesn't the frame break in the smaller section?" The reason is that the frame was not churned as it should have been while it was being cast. The smaller section cools before the larger sections, and as it contracts pulls the material in from the larger section. On an order of frames I recommended that a riser be placed at every large part on the frame, at the top of the legs and down through the front sections where there is a large body, and that the inspector make special efforts to see that the frame was well churned while it was being cast. We got 50 engines with those frames, and when they went through the shop they were perfect.

HEAT TREATMENT OF METALS

J. F. Keller, of Purdue University, showed on an emery wheel how the different kinds of steels could be determined by the sparks. He described to some extent the change in molecular structure of steel undergoing heat treatment and the benefit derived from such treatment. He also quoted from the 1911 proceedings of the American Society for Testing Materials as to the proper methods of heat treating various steels, stating that section 14 under the heading of Practice Recommended for Annealing Miscellaneous, Rolled and Forged Carbon Steel Objects would especially appeal to the master blacksmiths. This section is headed as follows: "14: Special annealing to remove the effect of rolling or otherwise working the object in the cold or at any unduly low temperature, and states that for steel containing less than 0.15 per cent. carbon the object should be heated to about 1,652 deg. F., and cooled with a slowness which should increase with the thickness, i. e., the least dimensions of the piece. Great brittleness may be caused by annealing very low carbon steels in the neighborhood of 1,292 deg. F., after they have been subject to cold working.

T. J. McSweeney (B. & O., Baltimore, Md.)—In treating self-hardening steel we have found it best to follow the instructions of the manufacturer. To anneal it we pack the pieces or parts in a box with the bone that we have used for case-hardening, and heat until red, then allow it to cool in the box. In treating beading tools we cool the tool off in oil and then bring it to a cherry red and quench in oil. In treating carbon steel, such as shear blades, etc., where the blades are 36 in. long and over, it is quite difficult to keep them straight in treating and tempering. With 2 in. x 8 in. x 36 in. blades, heat to 1,200 and 1,400 deg. F.; then put into a tank of flowing water for 30 seconds, and then into a tank of oil and leave to cool off.

F. F. Hoeffle (L. & N., Louisville, Ky.)—An axle should be allowed to cool after final forging before it is given any heat treatment, for the reason that in the process of forging there is liable to be an unequalized condition of the metal, such as hard spots on the surface and internal strains. Tire steel used for blacksmiths' tools, such as flatters, fullers and swedges, will not stand the treatment that a good carbon steel tool will, and by the time it has been cut and hammered down to the proper size it will have cost considerable.

R. Maronde (Ill. Steel Co., Chicago, Ill.)—The accompanying table gives a portion of the results of tests made by the Illinois Steel Company on three link chains of $\frac{3}{4}$ in. material to compare the effects of various methods of the heat treatment. Three

tests were made of each of the following methods and the average results are given in the table:

Method of Annealing.	Per Cent. Elongation.	Ultimate strength. Lbs. per sq. in.
Heated in a forge fire to 1,000 deg. F. and buried in ashes for 2 days	23	32,600
Heated in a forge fire to 1,000 deg. F. and cooled in air	23	32,530
Heated in a coke furnace to 1,500 deg. F. and quenched in tempering oil and then reheated to 1,100 deg. F. and cooled in air	23	32,800
Heated in a wood fire to 1,000 deg. F. and buried in ashes for 2 days	25.2	31,566
Heated in a wood fire to 1,000 deg. F. and cooled in air	17	29,600
Old chain that had been in use for about six months without annealing	12	31,733
New chain made of dredge iron	30	31,666

Geo. F. Hinkens (Westinghouse Air Brake Co., Wilmerding, Pa.):—Our company has specifications covering the heat treatment for all forgings subject to stresses. With proper heat treatment we can get a high elastic limit with ductility, especially with vanadium steel.

PIECE WORK

T. F. Keane (Ramapo Iron Works, Hillburn, N. Y.):—There are many things to be said concerning the advantages of piece work over day labor. With piece work a man's ability is accurately known. The men will not only apply all their skill in

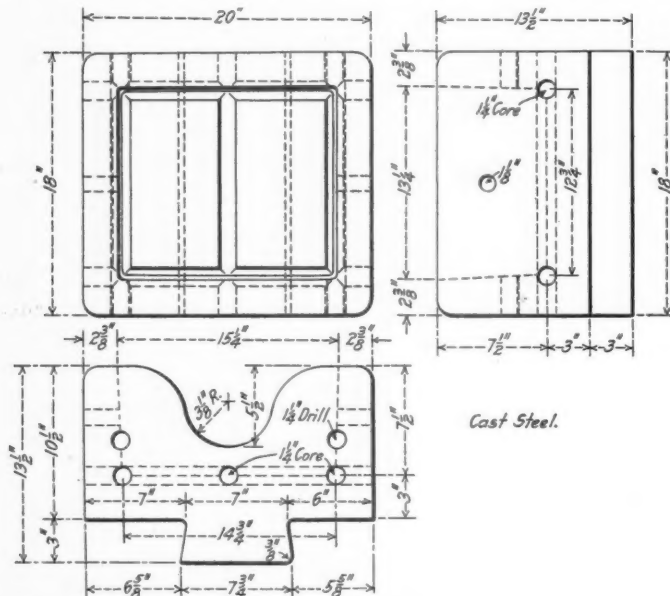


Fig. 8—Foundation Die for 4,000 lb. Steam Hammer; Central of New Jersey.

doing the work, but they will improve their output and learn better and more efficient methods of handling their tools, so that they may work them up to greater capacity. Always give the same kind of work to the same man, as men constantly doing the same work will increase their output and turn out better work. Cutting piece work prices shows great ignorance and inexperience on the part of a piece-rate man. It is a sign when some men make more money on their piece work that they are taking an interest in their work and that they are hustling and working more efficiently. If their work is done properly they deserve all the money they can make. The chances are if another man was put at the same work he would not be able to make as much.

The man should understand that the price set on a piece of work is satisfactory to the employer, provided, of course, that it had been set properly in the first place, and that what the employer wants is production. It pays to treat the men with consideration and investigate their complaints if they make any. And it may be necessary at times to raise a price to take care of certain unforeseen conditions. There are hundreds of little things to consider. If everything is given the proper attention there is no reason why the straight piece work system should

not be looked upon with favor by the employee, who through it will make more money.

SHOP KINKS

G. W. Kelly (C. R. R. of N. J., Elizabethport, N. J.):—A foundation die used on a 4,000 lb. steam hammer is shown in Fig. 8. It is a steel casting which is keyed to the base of the

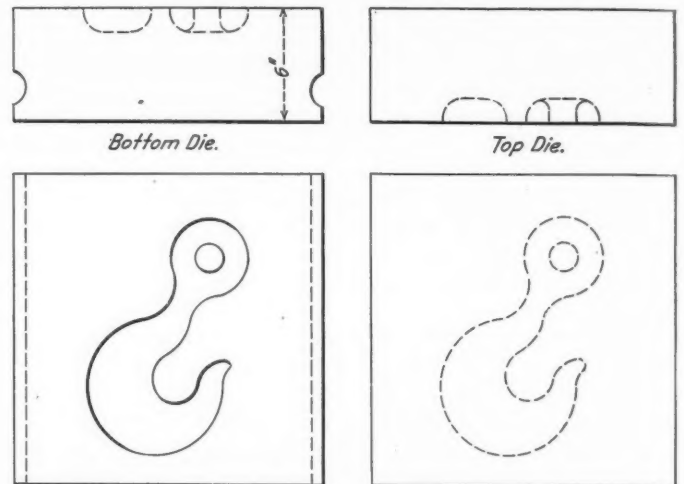


Fig. 9—Hammer Dies for Making Hooks; Central of New Jersey.

hammer, and is hollowed out and holds smaller dies 5 to 5 1/2 in. thick, for making link hangers, valve rod ends, hooks, etc., where the number to be made would not warrant the making of

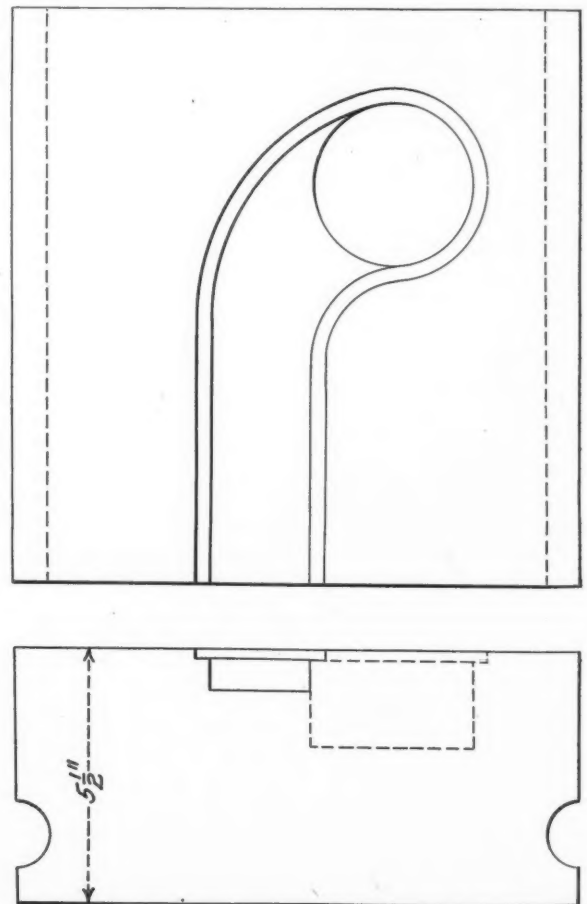


Fig. 10—Hammer Dies for Making Valve Rod Ends; Central of New Jersey.

larger dies. This is a convenient arrangement, the blocks being easily handled and simple to make. Should the impressions be too rough after they have been cast heat them before they are

planed and smooth the impression by pressing in a neat forged sample of the work to be done by the dies. Figs. 9 and 10 show a set of these dies for making hooks and valve rod ends. With this arrangement a number of different forgings can be made in a short time.

Forging machine dies for making grate shaker rods are shown in Fig. 11. The plate *A* is adjustable, as shown on the drawing. The lug is cut by the beveled cutter at *C*, which leaves the 2 in. \times $\frac{3}{4}$ in. iron bar shaped for the next weld without wasting the

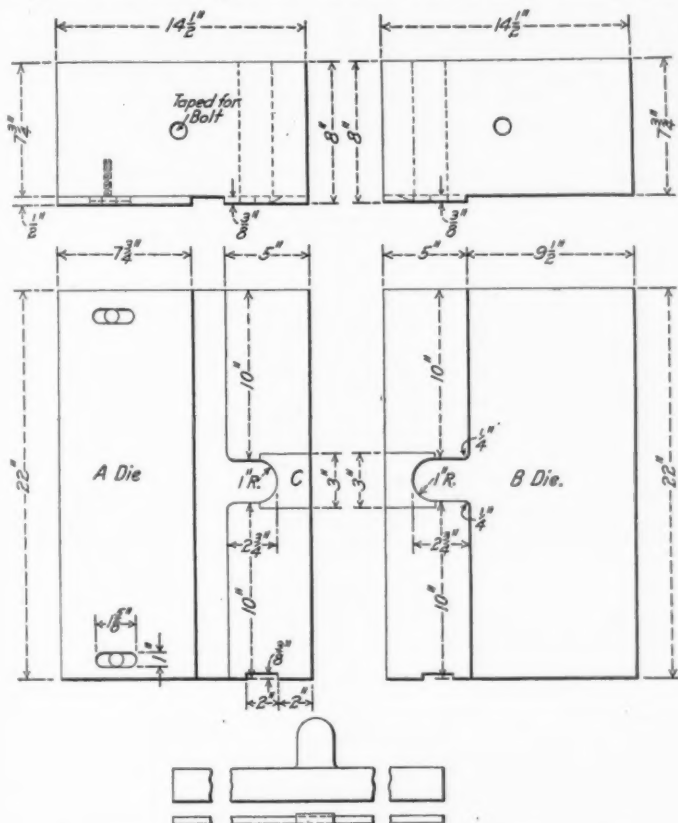


Fig. 11—Dies for Making Grate Shaker Rods; Central of New Jersey.

material. The weld is completed by a blank plunger striking the plate *A*.

An eyebolt die that provides for either a $1\frac{1}{4}$ in. or $1\frac{1}{8}$ in. stem is shown in Fig. 12. The head of the bolt is bent on a machine with a $1\frac{1}{2}$ in. eye and by using either the upper or lower side of the right hand die in the illustration, either size stem may be welded on. The impression in the left hand die was made in the smith shop. A neat forging was made the same size as the eye and pressed in the hot die under the steam hammer. The surface of the block was then machined and the block reheated so that the forged eye could be pressed in further until the correct depth of the impression was obtained.

Fig. 13 shows an effective method of removing defective brake shoe heads from a Kewanee passenger or freight brake beam. A block is placed on the back rest of a bulldozer, as shown, and

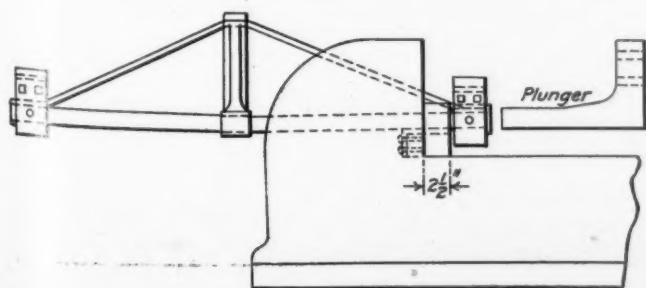


Fig. 13—Effective Method of Removing Old Brake Shoe Heads from Brake Beams; Central of New Jersey.

the plunger pushes the brake beam through the head, shearing off the rivets.

A. McDougall (Bangor & Aroostook, Milo Junction, Maine):—

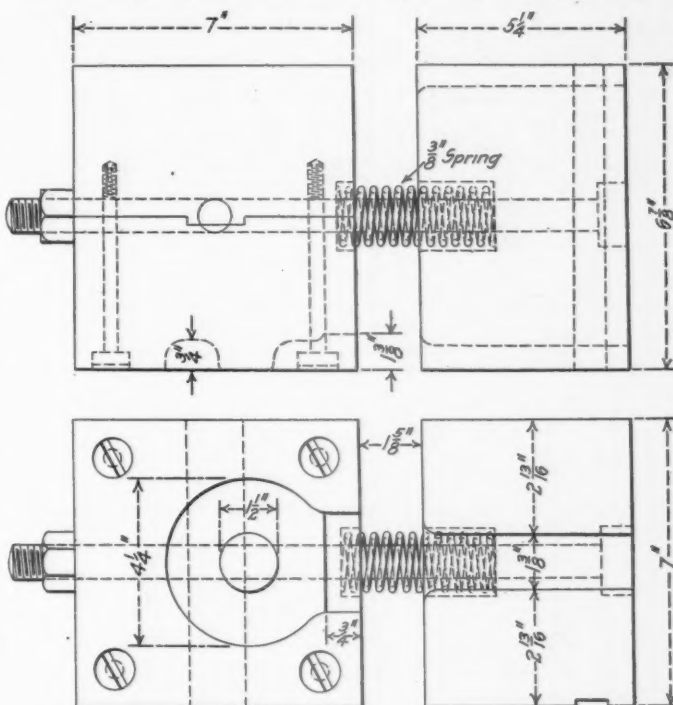


Fig. 12—Dies for Making Eye Bolts; Central of New Jersey.

The device shown in Fig. 14 is used for cutting off old car bolts. It is made up of old 4 in. x 6 in. angles with two 8 in. x 12 in. brake cylinders. The pistons of the two cylinders are con-

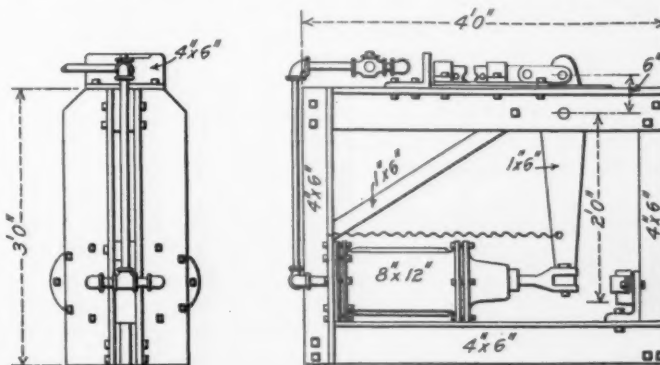
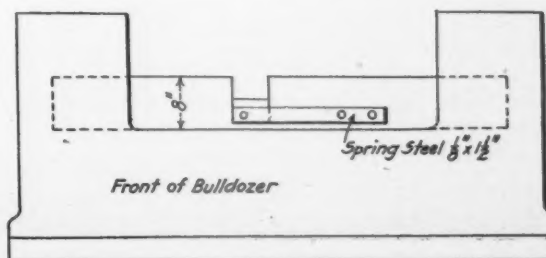
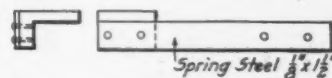


Fig. 14—Bolt Stripping Machine; Bangor & Aroostook.

nected by a U-shaped iron into which the end of the lever fits. A spiral spring is connected to the lever and the back of the frame to draw it back in position for cutting. A rubber cushion



nace. Any one making their own rings will find this an efficient outfit, the material for which can be found in nearly every railway scrap yard. The press is also useful for a number of other jobs that require straightening.

A method of making brake hangers is shown in Fig. 18. The

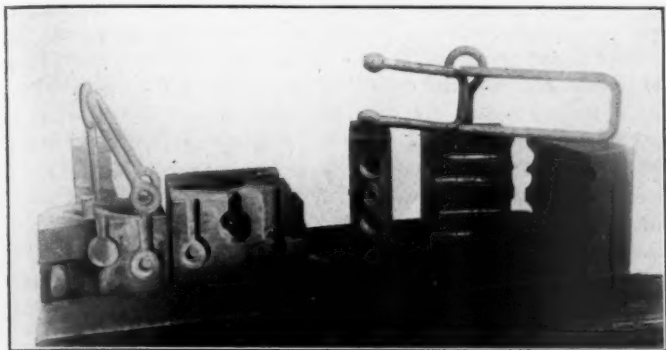


Fig. 18—Dies for Making Brake Hangers; Canadian Pacific.

rod is first bent to a U-shape on a bulldozer and both ends are upset at one operation on a forging machine. It is then passed to another machine and finished. We use two machines for doing this so as to perform the whole operation in one heat.

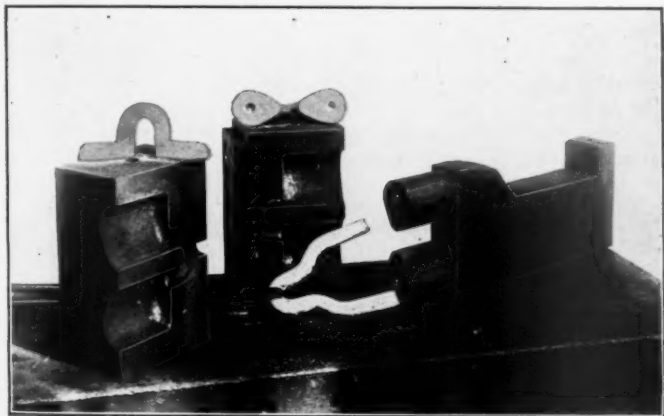


Fig. 19—Dies for Making Safety Chain Eyes; Canadian Pacific.

The die shown in Fig. 19 is used for making safety chain eyes for passenger car trucks. The first operation is performed on a bulldozer and one blow of the forging machine completes the work.

Dies for making baggage car grab irons are shown in Fig. 20.

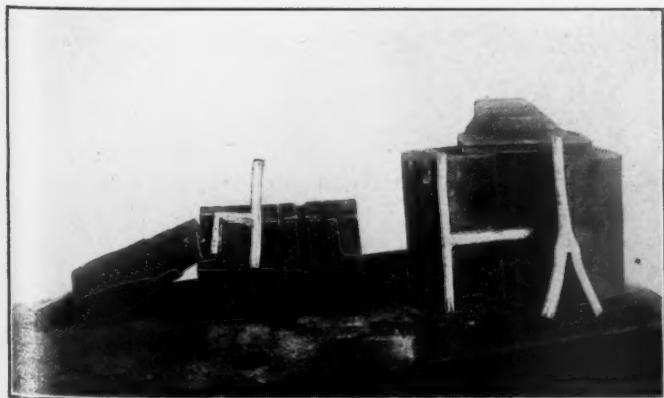


Fig. 20—Dies for Making Baggage Car Grab Irons; Canadian Pacific.

A Bradley hammer is used for drawing a $1\frac{3}{4}$ in. x $\frac{1}{2}$ in. rod to $\frac{5}{8}$ in. round. The material is then cut with a saw and finished on a forging machine.

D. M. Dulin (N. & W., Portsmouth, Ohio):—Figs. 21 and 22 show dies used for making wedge bolts and great iron ends. A wedge bolt can be made with one stroke of the machine. The plunger die is forced back by the 1 in. springs and is held in place by two $\frac{1}{4}$ in. guide plates.

The grab irons are made with two strokes of the machine.

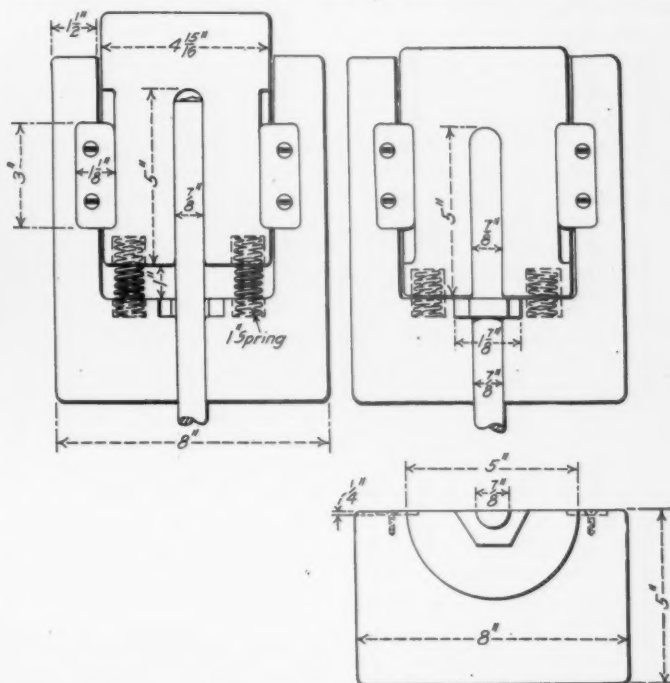


Fig. 21—Dies for Making Wedge Bolts; Norfolk & Western.

The first stroke upsets the end and the second flattens it out and punches the hole part way through it with the little knob on the end of the die. The ends are bent to shape at the same heat on a portable bulldozer that is located near the operator. When both ends are formed the grab iron is taken to a punch and the burrs are removed from the holes in the ends. With this

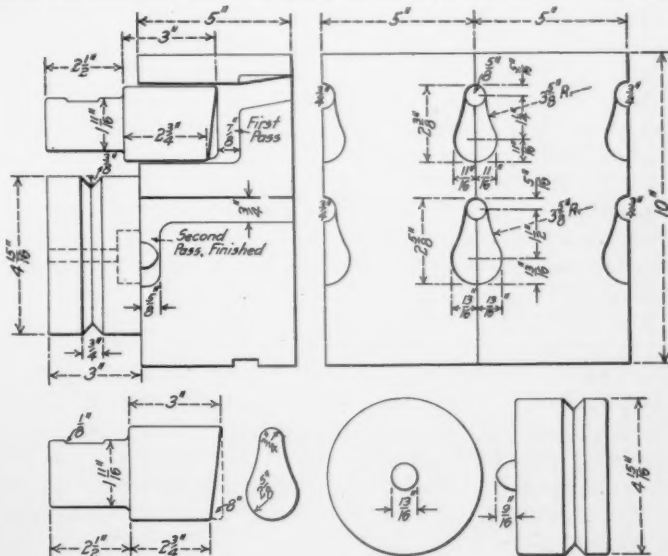


Fig. 22—Dies for Making Grab Iron Ends; Norfolk & Western.

arrangement we are able to make a clean cut hole, which is sometimes hard to do when punching iron while hot.

OXY-ACETYLENE WELDING

C. J. Fackler (Am. Car & Foundry Co., Jeffersonville, Ind.):—We have the Davis-Bournonville system in our plant, and as an experiment I had five welds made in $\frac{3}{8}$ in. and a $\frac{5}{8}$ in. round

ENGINE HOUSE EQUIPMENT AND FACILITIES

Suggestions as to Some of the More Important Tools and Appliances, and of the Principles Which Should Govern Their Selection.

BY ERNEST CORDEAL,

Bonus Supervisor, Atchison, Topeka & Santa Fe, La Junta, Col.

Under the head of engine house facilities are to be considered the tools, machines and appliances which are, or may be, employed to facilitate the handling and repairing of engines in service. Facilities should not, as is often the case, be given an exaggerated value in their effect upon the total efficiency of operation. Adequate facilities do not insure efficient operation, and lack of them does not imply inefficient performance. The best of tools and appliances in the hands of a poorly organized, incompetently directed force are simply an added expense in the form of excessive overhead charges. Scarcity of machines or tools, or the antiquity of their design, will be only a more or less serious handicap to an engine house otherwise efficient. Any shop may be over equipped as easily as under equipped, and the results on a cost basis are apt to be more serious in the former than in the latter case.

It should be acknowledged, then, that organization is the prime factor and that adequate modern equipment, while a great aid in minimizing costs and limiting time of detentions, is only an item of secondary moment. Only after the force has been properly organized and comprehensive reports and records have been provided to furnish accurate data as to performance is it possible or profitable to make an intelligent study as to requirements. Any attempt to provide modern tool equipment for an engine house at which efficient organization is lacking would in all probability result in over equipment and increased costs, while the same result may obtain should the modernizing of a well organized plant be undertaken without careful figuring as to the first cost, depreciation and utility of the facilities to be introduced.

There is a tendency on the part of engine house foremen and master mechanics to lay undue stress on the matter of facilities. A lack of equipment is probably the most common excuse advanced to explain inefficient operation and high repair costs, while in truth this feature is probably the least prevalent cause of unsatisfactory conditions. It is not the intention to convey the impression that up-to-date equipment is an undesirable adjunct to the engine house, but it is absolutely essential that careful, intelligent study should precede the ordering of expensive machines and tools to insure a fair return on the investment. As a concrete example of insufficient consideration of the needs in the purchase and installation of expensive appliances might be cited the case of traveling cranes in some comparatively small engine house where the service obtained would not pay the interest on the money invested, and where by the exercise of competent planning and supervision the work could be performed at a slightly increased labor cost in equal or less time without the crane. Before recommending the amount and quality of equipment to be supplied to any engine house a thorough investigation should be made to determine definitely the following points:

- (1) Cost of the appliance and depreciation rate.
- (2) Quantity of work to be handled.
- (3) Possibility of making the repairs in question at other engine houses.
- (4) Cost of operations performed by the appliance.
- (5) Cost of operations without the appliance.
- (6) Value of possible time saving.

Under the first head should come a consideration of all the machines on the market designed for the performance of the

work in question. This investigation should cover the first cost, durability, capacity and adaptability of the machine. After definite conclusions have been reached as to what may be expected of the various types of machines available, the second item, that of quality of work which may be handled, should be introduced and a careful estimate made as to the proportion of time which it will be profitably possible to keep the machine in use. The possibility of so arranging the performance of certain classes of repairs as to centralize the work at one point on a division should be carefully considered. For example, it may be found that a drop pit at one terminal will be able to handle all of the driving wheel work for the division and that a little foresight will enable all the power to be handled in such a way as to allow for the necessary detention at that point when repairs of this nature are necessary. It would then be obviously unnecessary to place drop pits at both ends of the division, and the one which was installed might be made more efficient by allowing for its construction a part of the cost of the second pit.

When the quantity of work of a certain class which will be performed is known, together with the output capacity of the various available machines, it is a matter of simple calculation to determine which appliance will effect the best results. The machine which guarantees the lowest piece cost will not prove the most economic unless the quantity of work is such as to permit almost continuous operation, and it is therefore necessary to base cost figures on the output of a certain period, preferably a year, rather than on the direct cost of labor and machine charge per piece. In computing estimated costs the items which must be given consideration are: labor, power, depreciation of machine, and interest on money invested. Any appliance which fails to show a lower piece cost, when figured on this basis, than that obtained with the old facilities, is an item of extravagance which should not be considered.

Another item which should not be overlooked is that of the possibility of reducing the time of detention; in other words, increasing the time locomotives are in actual revenue earning service. A saving in time on the performance of a particular item of repairs does not necessarily imply that an equal amount of time is added to the actual time in service of the locomotive; in fact, on the contrary, as a general rule, the repairs can, under competent supervision, be completed in less time than that allowed for rest to the engine crews and for washing boilers and otherwise preparing for the return trip. Any time saved which can not be utilized by the engine in actual service is valueless and should therefore receive no consideration in estimates covering improved facilities.

A number of specific items which may be classed as engine house facilities will be taken up in detail to illustrate the method which should be employed to determine their economy and some suggestions will also be made as to what equipment is necessary under various conditions.

CRANES.

The employment of traveling cranes in engine houses to facilitate the handling of material from one place to another, or in lifting heavy parts to place, may in general be considered as uneconomic, except as applied to very large points. Let us assume that the point under consideration has a thirty stall

house handling on an average sixty engines a day. A careful study will probably determine that a labor gang of ten men at a rate of \$1.50 a day could handle all of the material and provide help for handling all the heavy repair parts. Conceding that the crane, if installed, would take the place of these ten laborers, the next step is to determine whether or not the crane could be purchased, the necessary supporting structure erected, and the power, repairs and operators furnished at a less yearly cost than that of the original labor gang. In the case cited it would be necessary to show a yearly cost of \$4,500, allowing 300 working days to the year. Estimating that the yearly cost of operation for the crane, including wages of operators, cost of power and cost of repairs, amounted to \$1,500, it would then be necessary to determine whether the crane could be purchased and installed at a cost which would provide for interest and depreciation. It will be noted that the difference between the cost of operation of the crane and the cost of labor to perform a like amount of work leaves a yearly sum of \$3,000. Making an allowance of eight per cent. for interest and depreciation, it will be seen that this surplus would render economical the installation of a crane at a cost of less than \$37,500.

Crane service in the engine house can not be considered as a time saving feature, for, although it is true that parts may be transferred from one place to another, or can be raised to position in considerably less time, the actual saving on any one job will be more than swallowed up by delays on other work due to the fact that the crane can perform but one operation at a time, and that the time wasted by mechanics in waiting for crane service will be much greater than where a labor gang is provided. A labor gang has the advantage of being susceptible of division into the number of units composing it, for the simultaneous performance of a variety of small jobs and concentration into one force in case of need, while the crane can only perform one operation at a time regardless of the amount of power required. An additional advantage of the labor gang over the crane is that in times when the work is not sufficient to require the whole gang, or the entire time of the gang, a part of the members or a part of the time may be utilized on other classes of work, while in the case of the crane standing idle, or only working at a part of its capacity, the overhead charge to be borne by foregoing and subsequent operations would be accruing.

DROP PITS.

One of several methods may be employed for removing a pair of driving wheels. If a crane of sufficient capacity is available the simplest method is to merely lift the engine off of the wheels. A locomotive hoist accomplishes the same result in a considerably increased time; or at a great expense of time and labor the engine may be jacked up until the wheels can be rolled out. The drop pit, however, presents advantages for engine house use over any of the methods mentioned. The pit when properly erected should be as permanent as the engine house itself, and the charges for repairs will be negligible. When equipped with a proper jack for lowering and raising the wheels the operation, when only one pair of wheels are to be removed, should consume less time than any of the other methods with the possible exception of the crane. The consideration of cranes of high capacity for engine house use is obviously out of place as the higher cost and small range of utility would prohibit their installation.

The hoist or drop table may be used to advantage in a very large engine house where it is a common practice to remove two or more pairs of drivers and where the volume of work of this nature warrants the expenditure of the comparatively large amount of money entailed in their purchase and installation. For the ordinary engine house, however, the drop pit serves all purposes to the best advantage and insures the lowest unit costs. As has previously been mentioned, it is not necessary that every engine house be equipped with a drop pit, as

with proper supervision as to conditions, it is perfectly practical to so handle locomotives that work requiring the dropping of wheels may be performed at one main point for each division. When drop pits are to be installed, or old ones remodeled, the actual work should be preceded by a careful study of the amount of work to be handled to determine the number of engine pits which it will be necessary to use for this class of work. The dimensions of pits should be made to provide for all of the variations in types of power in actual service or in prospect, so as to avoid frequent remodeling or inconvenience in performing work on engines with exceptionally high drivers or an unusually short wheel base. Pits should be constructed with a view to permanency, reinforced concrete being probably the best material for the purpose. The provisions for draining should be given special attention to insure a clean, dry pit under all conditions.

Nothing is as destructive to drop pit jacks as being allowed to stand in a pit partially filled with water, nor is anything so discouraging and distasteful to workmen as being required to work in a slimy, evil-smelling, unsanitary hole. The jack carriage should be made as wide and with as long a wheel base as possible to insure the greatest protection from tipping and also to facilitate its easy movement under load. The jack head should be constructed to give ample support for the wheels to avoid any danger of their slipping off and falling into the pit. The best type of jack for drop pit use is a subject of considerable difference of opinion, some mechanics holding that the hydraulic type, although very much slower and requiring more physical effort for its operation, is better adapted to the purpose on account of the steadiness of movement which minimizes the liability of accident. The air jack, however, while considerably cheaper as to first cost and maintenance, and many times faster in operation, if carefully constructed and so arranged as to provide for raising and lowering by means of a valve placed so as not to require the operator to stand in the pit, will prove a far more satisfactory machine for the purpose.

The question is often asked, when drop pit improvements are suggested, as to how much can be economically expended on this facility, presupposing that redesign will effect a certain saving in time and labor per pair of wheels dropped. Let us suppose that with the old equipment a mechanic and helper, with rates per hour of forty and twenty cents respectively, are able to remove and replace a pair of wheels, considering only such time as influenced by the pit facilities, in four hours, which represents a labor cost of \$2.40. Assuming, then, that improvements can be made which would reduce the time of removing and replacing the wheels to two hours at a labor cost of \$1.20, it is still necessary to determine the average number of wheels which it will be necessary to drop. Let us say that from past records it is found that an average of one pair of wheels are handled each day. By reducing the labor cost by \$1.20 per pair this amount of work would provide a fund of \$438 per year to pay the interest and depreciation on the new equipment. Assuming the rates of the two combined at 8 per cent., it will be seen that an expenditure under \$5,475 would be justified in making improvements which would insure the decrease in time. The feature of time detention should also be considered when drop pit improvements are contemplated, as with effective equipment work on driving wheels and boxes may be done within the time ordinarily allowed for handling and rest of crews, and it becomes unnecessary to hold engines out of service, as is often necessary on account of inadequacy of facilities.

Before leaving the subject of drop pits it might be well to say a word as to the provision of small pits for the purpose of handling engine truck wheels. The common practice of jacking up the engine, removing and replacing the pilot, and tearing apart the truck frame to renew a pair of engine truck wheels, or their boxes, is by no means an efficient operation, and a comparatively small amount of this work would warrant the

consideration of one or more small pits for handling these wheels.

JACKS.

It is doubtful whether there is any one item under the general head of facilities which deserves more close attention than that of jacks for raising engines. Poor jacks, or jacks of insufficient power, are the cause of much wasted time. Another large item of time waste is often engendered by the careless method of handling which leads to the impression that the supply is insufficient when in reality the number of jacks is ample for all needs, provided they can be found and are in proper condition for use when desired. Every engine house should be equipped with jacks of sufficient capacity to raise without difficulty the heaviest class of engine on the division, the number of such jacks required at any point being easily determined from a study of the class and quantity of repairs to be handled. Hesitancy is often exhibited by engine house foremen and master mechanics in the ordering of new jacks for the reason that the best articles in this line are very expensive; however, the initial cost of good jacks will be insignificant when compared with the saving in cost of operations which they are able to effect.

Cases have often come under observation in which two or more men have spent from three to five hours in trying to raise an engine with poor jacks or jacks of insufficient capacity, when the operation might have been performed in one-half hour or less with the proper facilities. An item of equal or perhaps greater moment than the supplying of jacks of proper number and capacity is the care of such equipment when furnished. These machines are in need of almost constant attention in order that they may be kept in the best of condition. A certain man, fully conversant with the work, should be assigned the duty of making the necessary repairs, and he should be held responsible for their condition. A platform centrally located should be provided on which all jacks should be kept when not in use, and definite instructions should be issued insuring their return to this place as soon as operations requiring their use are completed. It is safe to say that six or eight good jacks, which should be a sufficient number to handle the work at any engine house of average size handling, say, fifty to sixty engines a day, would pay for themselves and their care many times over during a year by the amount of time saved on the various operations.

MACHINE EQUIPMENT.

The engine house requirements as to machine equipment will vary greatly with the class of work to be handled and the proximity to the shops. The engine house which is located at a point where no back shop is in operation must be provided with a sufficient number and variety of machines to take care of all the machining operations which will ordinarily arise. As a rule, such engine houses are of minor importance; that is, they are located at intermediate points between division terminals where shops are provided, and the work they are required to perform is therefore only the lightest of running repairs. It is not economic to provide such engine houses with expensive up-to-date machines, as their use would be intermittent and a large part of the time they would stand idle. A few old machines, which have served their term of usefulness in a shop, when carefully repaired, will serve all purposes, and will allow for a minimum cost of performing operations, as the hourly machine charge will be very low, although the labor charge will, of course, be slightly higher than with a new machine.

A small engine lathe, shaper, drill press and single head bolt cutter, with possibly a small planer, will generally furnish the necessary equipment for such points. The original cost of this equipment when supplied from the discard of large shops will be very small indeed, and if the machines are put in good repair before installation and are kept in good condition by periodical overhauling, they will handle the ordinary run of work at a minimum cost.

The engine house which is located at a shop point is the one which deserves the most careful investigation as to machine equipment. It is too often the case that an engine house so located as to be within a few hundred feet of a back shop is provided with no machines whatever, making it necessary for every job, no matter how small, to be taken to the machine shop. This system presents many disadvantages, both to the engine house and to the shop management. The machine shop foreman has constant occasion for complaint in that his regular shop work is delayed and his plans interfered with on account of the necessity of giving engine house work preference, which often entails the removal of a piece of work from a machine in order to substitute a rush job. The machine operator loses a very considerable amount of time in making trips to the engine house to obtain measurements. The engine house mechanic wastes a far greater amount of time in taking his work to the machine shop and waiting for it, or running back and forth at frequent intervals. The simple operation of fitting a bolt will require the machine operator to make two or more trips to the engine house, consuming more time in making the trips than in turning the bolt. The drilling of a hole in a clamp or bracket, which requires but a few seconds, will entail a trip consuming several minutes.

A little study will show conclusively that a few simple machines centrally placed in the engine house, manned by one or more all-around operators, will effect a saving in time of repair men, will relieve the machine foreman of much aggravation, and will provide a means of rendering the engine house more or less independent of the shop, which is at all times desirable. Such equipment should only provide for the performance of those operations which are of frequent occurrence, and should not be expected to take care of work requiring heavy machining, as this can be accomplished by the regular shop machines at less cost. A small engine lathe for fitting bolts and pins, turning piston and valve stem packing and other miscellaneous small parts; a small drill press and bolt cutter to handle the innumerable operations of this nature; and a small planer or good sized shaper for reducing rod brasses or eccentrics, planing keys, liners, shoes and wedges, crosshead gibs and other small parts would, as a rule, be a sufficient equipment for the ordinary engine house, although it will occasionally prove expedient to install a small high speed boring mill for boring rod brasses, eccentric straps, rocker boxes, etc. When considering the machine equipment of engine houses it should be borne in mind that the actual time consumed, or the cost of the various items, will not be as low as for the same operations performed in the machine shop, the great advantage gained being in the time saved by eliminating the trips between shops.

TOOL ROOMS.

The tool room is as necessary an adjunct to the engine house as it is to the shop, and should be as fully equipped and efficiently handled. The best of tools are of doubtful advantage unless properly cared for and easily available. The engine house tool room should contain a supply of all of the regular and special tools needed for the performance of the various operations included in running repairs, and should be in charge of a man, or men, who are competent to make the repairs necessary to keep them in the best of condition.

There are certain tools, of course, which it is necessary for each mechanic to have with him at all times, such as a hammer, chisels and monkey wrenches, and these tools should be kept by the workmen. Then there are the regular tools such as sledges, bars, wrenches for various parts, small jacks, motors, air hammers, etc., which are in demand at all times, but not sufficiently so to require their being furnished to each individual workman. These tools should be kept in the tool room where they may be obtained with as little trouble and loss of time as though they were kept in the cupboards of the workmen,

as is often the practice. Keeping these tools in a tool room provides for their proper care and prevents their loss or destruction, as it also insures the minimum necessary number of each article.

It has been observed that in the average engine house a large part, even to a majority, of the time of the mechanics is consumed, not in the actual work, but in getting together the necessary tools and materials for its performance. In many cases each mechanic is provided with a helper regardless of the class of work to which he is assigned, the reason being given that the low rate man may save the time of the mechanic by making the necessary trips to the tool room, store house or shop. A much more economical plan would be to employ tool runners who, under the direction of the repair foreman, would do the necessary running about for an entire gang of men.

BOILER WASHING.

Perhaps the most important of comparatively recent inventions for facilitating the handling of engines is the hot water boiler washing system. The advantages of this system have been so widely advertised and its adoption has been so universal that extended comment would seem unnecessary. Under the old cold water system the operation of washing a boiler was one which could not be rushed for fear of damage to the firebox and boiler; engines were frequently held from their regular runs or let go out dirty. With a properly constructed hot water system, cooling down is unnecessary, the actual draining, washing and filling processes consume but a few moments, and there is no danger of damage to the sheets. The system has the triple advantage of saving time and therefore reducing the cost of the operation of washing, insures the minimum time out of service for the locomotive, prolongs the life of sheets, staybolts and flues, and thereby reduces the cost of boiler repairs and the frequency of boiler troubles.

SIGNALS.

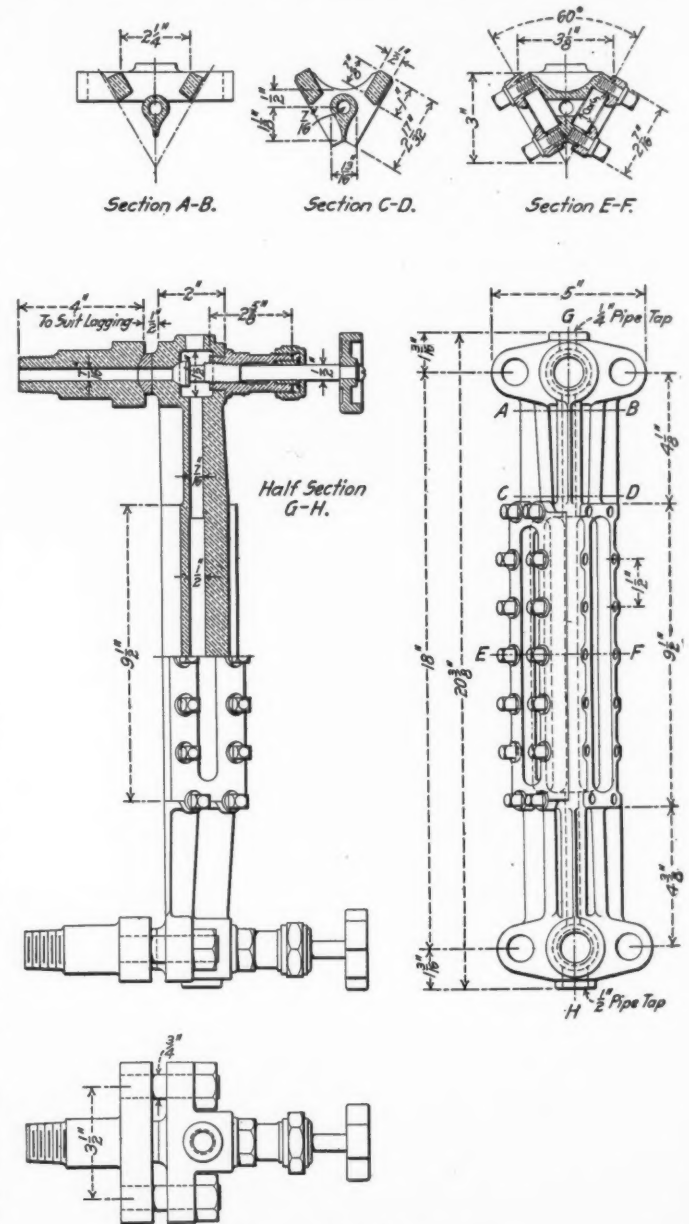
In very few engine houses has the importance of a signaling system been recognized. The engine house foreman, one of the busiest of men, spends a large part of his time hunting for his various under-foremen. If you have ever tried to find a particular man in a busy engine house you will realize just what a proposition this is. Some one is constantly wanted, the hostler to move an engine, the inspector, the boiler foreman, anyone of the various gang bosses, and the common method is to inquire and hunt until they are located. A simple and inexpensive method of alleviating this condition, thereby saving much valuable time and many miles of walking, is to install a small air whistle in the foreman's office. A code of signals can be arranged so to attract the attention of the person required.

The system of signaling may be carried still further by providing a line of electric push buttons connecting each stall of the engine house with the tool room or foreman's office. This system, together with the employment of tool and material runners, will save a great deal of the time of high rate mechanics, as when they are in need of a tool from the tool room or material from the store house or the assistance of the labor gang, they may make their wants known without leaving their work.

The suggestions which have been made do not in any degree cover the ground embraced under the head of engine house facilities, nor has there been any attempt to point out just what the best equipment would be for any particular engine house. The whole object has been merely to place the subject in such form as to emphasize to engine house foremen and master mechanics the importance of making a thorough study of conditions to determine what can and should be done to assist in the handling of engines, and to assist them, if possible, in figuring the savings which may be expected from improved facilities so that these things may be placed before the officers who make the appropriations in such light as to insure their approval.

GOODWIN DUPLEX WATER GLASS

A high pressure water glass arranged so that both members of the locomotive crew can see the water level from any point in the cab without the use of mirrors, has been applied to the Pacific type locomotives recently built for the San Pedro, Los Angeles & Salt Lake. This water glass was designed and is being manufactured at the Los Angeles shops of the Southern Pacific. It has a number of advantages in addition to its range



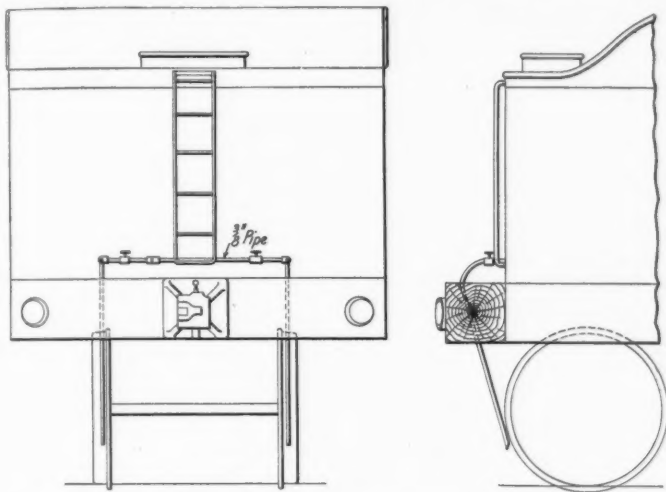
Goodwin Duplex Water Glass.

of visibility. Plain glass, $\frac{5}{8}$ in. in thickness, is secured in place in the same manner that the reflex glass usually is. The connection to the boiler fittings is made with ground joints, each end of the frame holding the glass being secured by two studs, eliminating the necessity of using any gaskets or nipples. A special ball washer is provided for the joint which can be easily ground in place. The material throughout, except the small studs, is of brass.

AROUND THE WORLD IN THIRTY-NINE DAYS.—E. J. Scott and J. A. Allen, of Phoenix, Ariz., claim they have encircled the globe in 39 days, which is about 19 hours less than the time made by the Paris reporter last year.

TENDER WHEEL LUBRICATOR

Some of the pusher locomotives on the Buffalo & Susquehanna operate over a switch-back in which there are five leads. The conditions at this point are such that the engines normally make about seven hundred engine miles to one hundred train miles. This service causes excessive flange and rail wear, the former being particularly noticeable on the pusher engine, and especially on the tender wheels. John W. Clark, the roadmaster, suggested experimenting with water lubrication and the arrangement shown in the accompanying illustration was applied. It consists simply of a $\frac{3}{8}$ -in. pipe tapped into the rear



Water Lubrication for Tender Wheel Tires When Operating Over Sharp Curves.

of the tender tank and carried down to a point about 8 in. above the rail near the tire of the rear tender wheels. Valves permit adjustment to allow the proper amount of water to play on the flanges and tire of the wheel. The improvement in both flange and rail wear, as well as the reduction in the tendency of derailment was immediately noticeable and the scheme is considered a success.

It has been found impossible to use it during the winter months, but at that time there is sufficient snow and rain on the rail to reduce the friction. It is used when the locomotives are backing up, as well as going ahead, and has caused no trouble from slipping of the drivers. When going ahead it

MIKADOS FOR THE LACKAWANNA

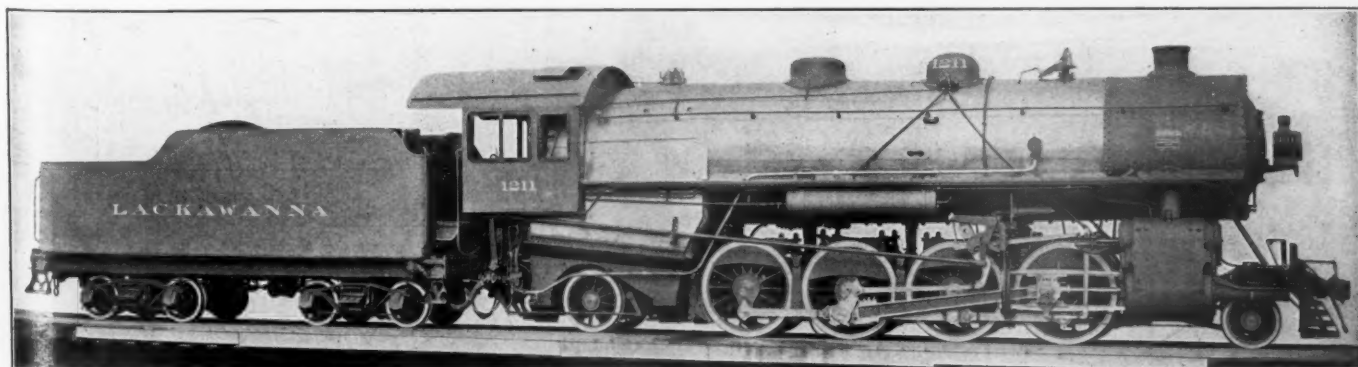
In addition to the seven large hard coal-burning Pacific type locomotives, illustrated on page 391 of the August issue of this journal, the Delaware, Lackawanna & Western is also putting in service 15 locomotives of the 2-8-2 type, built by the American Locomotive Company. These are to be used in both fast and slow freight service between Buffalo and Elmira, N. Y., the object being to operate larger train units. At the present time consolidation locomotives having 26-in. x 30-in. cylinders and a maximum tractive effort of 24,400 lbs. are used in slow freight service in this district, and locomotives of the 2-6-0 type with a maximum tractive effort of 29,480 lbs. are generally employed for fast freight trains. The new Mikados have 28-in. x 30-in. cylinders, 63-in. wheels, and a tractive effort of 57,000 lbs. They are fitted with very large high degree superheaters.

Compared with other locomotives of the same type that have been recently illustrated in these columns, the new Lackawanna engines stand among the leaders in weight and capacity. While they are exceeded slightly in total weight by at least three other recent designs, and in tractive effort by four other designs, there is but one other group of Mikado engines that exceeds them in evaporative heating surface, and since they were not fitted with superheaters the Lackawanna locomotives in regard to boiler power, judged from a basis of equivalent heating surface, are the most powerful of their type. The boiler is of the straight top type and measures 88 in. outside diameter at the first ring and 89 $\frac{1}{4}$ in. at the largest diameter. The accompanying table will permit a comparison with three other boilers of Mikado type locomotives. The most striking feature evident from this comparison is the size of the superheater that has

GENERAL DIMENSIONS OF BOILERS FOR RECENTLY BUILT MIKADO LOCOMOTIVES.

Road	D., L. & W.	C. & O.	Erie	C., R. I. & P.
Type of boiler	Str.	W. T.	Str.	Str.
Outside diameter at first ring, in.	88	83 $\frac{3}{4}$	84	86
Outside diameter at throat sheet, in.	89 $\frac{1}{4}$	96	87 $\frac{3}{4}$	89 $\frac{1}{4}$
Number and diameter of tubes, in.	304—2	238—2 $\frac{1}{4}$	232—2 $\frac{1}{4}$	238—2 $\frac{1}{4}$
Number and diameter of flues, in.	43—5 $\frac{1}{2}$	40—5 $\frac{1}{2}$	36—5 $\frac{1}{2}$	36—5 $\frac{1}{2}$
Length of tubes, ft.	21	19	21	21
Steam pressure, lbs.	180	170	170	180
Heating surface, firebox, sq. ft.	261.3	311.2	219	260
Heating surface, tubes, sq. ft.	4,592.8	3,740	3,936	4,004
Heating surface, total, sq. ft.	4,854.1	4,051.2	4,155	4,264
Heating surf., superheater, sq. ft.	1,065	845	843	848
Heating surface, equivalent, sq. ft.	6,451.6	5,318.7	5,420	5,536
Grate area, sq. ft.	63.1	66.7	70	63
Evap. H. S. \div superheater H. S.	4.56	4.79	4.93	5.03
Evap. H. S. \div grate area	76.9	60.7	59.4	61.5

been applied. Although 2 in. tubes have been used, which give the very large evaporative heating surface, still the superheater



Mikado Locomotive Designed to Haul Heavier Freight Trains Between Buffalo and Elmira on the Lackawanna.

washes the sand from the rails and reduces the resistance of the train.

ELECTRIC LINE IN AUSTRALIA.—The electrification of the suburban lines of Melbourne, Victoria, will include 300 miles of single track.

is even relatively larger and has one square foot of heating surface to every 4.56 sq. ft. of evaporative heating surface. This is about 5 per cent. less than the same ratio on the Chesapeake & Ohio, 7 $\frac{1}{2}$ per cent. less than on the Erie, and 9.4 per cent. less than on the Rock Island. The superheater is composed of 43 elements arranged in four rows of nine each and one top

Weight of engine and tender in working order.....	471,700 lbs.
Wheel base, driving.....	17 ft.
Wheel base, total.....	35 ft. 5 in.
Wheel base, engine and tender.....	67 ft. 7 in.

Ratios.

Weight on drivers ÷ tractive effort.....	4.15
Total weight ÷ tractive effort.....	5.47
Tractive effort × diam. drivers ÷ equiv. heating surface*.....	556.60
Total equiv. heating surface* ÷ grate area.....	102.40
Firebox heating surface ÷ total equiv. heating surface*, per cent.....	5.40
Weight on drivers ÷ total equiv. heating surface*.....	36.60
Total weight ÷ total equiv. heating surface*.....	48.50
Volume of both cylinders, cu. ft.....	21.40
Total equiv. heating surface* ÷ vol. cylinders.....	301.40
Grate area ÷ vol. cylinders.....	2.94

Cylinders.

Kind.....	Simple
Diameter and stroke.....	28 in. x 30 in.

Valves.

Kind.....	Piston
Diameter.....	16 in.
Greatest travel.....	7 in.
Outside lap.....	1 3/16 in.
Inside clearance.....	0 in.
Lead.....	1/8 in.

Wheels.

Driving, diameter over tires.....	63 in.
Driving, thickness of tires.....	3 1/2 in.
Driving journals, main, diameter and length.....	11 in. x 21 in.
Driving journals, others, diameter and length.....	10 1/2 in. x 13 in.
Engine truck wheels, diameter.....	33 in.

Smokestack, diameter.....	18 in.
Smokestack, height above rail.....	182 9/16 in.

Tender.

Frame.....	13 in. chan. center and 10 in. chan. side sills
Wheels, diameter.....	33 in.
Journals, diameter and length.....	6 in. x 11 in.
Water capacity.....	8,000 gals.
Coal capacity.....	14 tons

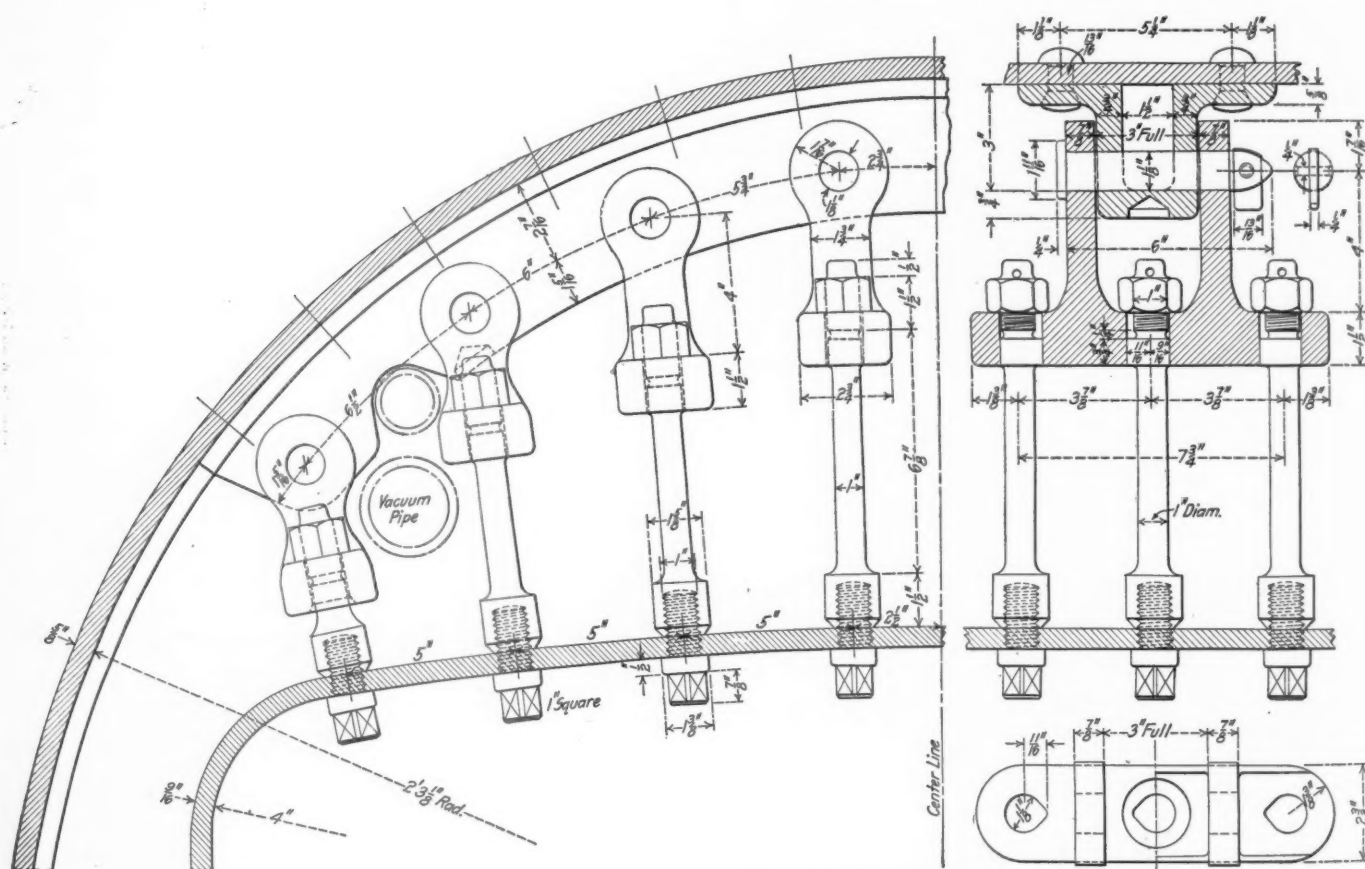
*Equivalent heating surface equals 4,854.1 sq. ft. + (1.5 × 1,065 sq. ft.) = 6,451.6.

A NOVEL DESIGN OF SLING STAY

BY GEORGE SHERWOOD HODGINS.

The boiler sling stays on the London & South Western express and tank engines are simple in construction and strong. On the roof sheet of the boiler, over the flue sheet, an old form of U-rail is riveted, and to this, at regular intervals, are pinned the crow's feet. The pin used is sharpened at one end and has a hinged key at the pointed end. This enables it to be pushed into place easily, and when in position the hinged key automatically locks it.

The stay itself drops through a hole in the crow's foot, and



Type of Sling Stay Used on the London & South Western.

Engine truck journals.....	6 in. x 12 in.
Trailing truck wheels, diameter.....	42 in.
Trailing truck journals.....	9 in. x 14 in.

Boiler.

Style.....	Straight
Working pressure.....	180 lbs.
Outside diameter of first ring.....	88 in.
Firebox, length and width.....	108 in. x 84 1/4 in.
Firebox plates, thickness.....	3/8 in. and 1/2 in.
Firebox, water space.....	F—6 in.; S. and B.—5 in.
Tubes, number and outside diameter.....	304—2 in.
Flues, number and outside diameter.....	43—5 1/8 in.
Tubes, thickness and material.....	No. 11, B. W. G. Iron
Flues, thickness.....	No. 9, B. W. G.
Tubes, length.....	21 ft.
Heating surface, tubes and flues.....	4,592.8 sq. ft.
Heating surface, firebox.....	261.3 sq. ft.
Heating surface, total.....	4,854.1 sq. ft.
Superheater heating surface.....	1,065 sq. ft.
Grate area.....	63.1 sq. ft.

is secured in place by a nut with a split key above. The "neck" of the stay has a pin on one side which fits into a recess in the crow's foot, and this enables the nut to be put on above, and the tap bolt entered from below. This arrangement subsequently prevents the stay from turning or slackening in any way. The crown sheet stay is practically a tap bolt which screws through the crown sheet and up into the enlarged socket at the lower end of the stay.

The whole arrangement is such that the stay is always tight in the crown sheet, and any vertical movement of the flue sheet tends to lift the nut on the crow's foot and provide the necessary "give and take" for the expansion and contraction of the firebox.

TRAVELING ENGINEERS' ASSOCIATION

The Twentieth Annual Convention Maintained the High Standard of the Previous Meetings of This Body.

The twentieth annual convention of the Traveling Engineers' Association was opened by President W. C. Hayes, superintendent of locomotive operation of the Erie, at the Hotel Sherman, Chicago, on August 27. There were about 375 members and guests present. After prayer by Dr. Kennedy Marshall, S. O. Dunn, editor of the *Railway Age Gazette*, was called on for the opening address.

ADDRESS OF S. O. DUNN

Mr. Dunn spoke forcefully of the necessity for greater efficiency of railway operation, particularly in connection with the work of the employees. After drawing attention to the continual decrease in the net earnings, due principally to the increase in operating expenses and taxes, he pointed out that although government regulation had been partially responsible, the main cause of the recent increases in operating expenses had been the advances in the wages of railway employees. He then continued as follows:

"All who are connected with railways agree that it is the duty of state and national governments, in regulating and taxing them, not to make or keep their rates so low as to impair reasonable gross and net earnings. A majority of those connected with railways think that the tendency of the regulating authorities is to make and keep rates and gross earnings too low. But net earnings depend not only on how much gross earnings are, but also on how much operating expenses are; and employees are not unanimous in believing that it is to their interest and is their duty to do all that they can to further the efficiency in operation, which is necessary to enable the roads, while paying reasonable wages, to keep operating expenses as low as practicable.

"All who work for railways and receive from them salaries and wages are employees. The president, the general manager, the superintendent, the traveling engineer are just as much employees as the engineman, the switchman, or the track laborer. But ordinarily we divide those on railway payrolls into the officer class and the employee class. Now, you and all other officers recognize the fact that it is to your interest to increase efficiency just as much as you can. It needs no argument to convince the traveling engineer that it is advantageous to so do his work that the number of tons moved one mile by each engine crew, by each engine and by each pound of coal shall be the greatest practicable. To accomplish this is what you are employed for, is what you are here for. But among employees, that is, among those who work for what are called "wages," as distinguished from what are called "salaries," there is a quite general opinion, not perhaps often explicitly put into words, but often very explicitly manifested in acts, that they have nothing to gain and something to lose by heartily co-operating with the railway managements in efforts to increase the efficiency of operation to the utmost. I need not detail any of the various manifestations. You are familiar with them, because you are on the firing line all the time, laboring to get the greatest efficiency from the most important and distinctive part of railway equipment and those who handle it. This feeling is one that pervades a large part of labor in all lines of industry. The employees are apt to say—if not in words at least in attitude and acts—that the company will, of course, gain by getting as much and as good work as possible from each man. They are apt to say that the individual officer will also gain; by this means the traveling engineer may get promoted to master mechanic or assistant superintendent, and thence to higher positions. But

the effect on the employees, they are apt to contend, will be, not to increase their wages or reduce their hours of work, but to make necessary fewer men, and, thereby, throw some out of employment.

"As to promotion, the history of our railways and the biographies of their present officers show that the avenues leading up to the very highest offices always have been open to every employee. The managements are no more disposed to close that door on anyone now than they ever were. They know that the best way to get capable officers is to let the process of natural selection work itself out among all of the 1,700,000 employees. Today, as in the past, every hard-working and competent employee has a fair chance of being advanced for individual efficiency, even to the highest positions.

"Aside from the matter of promotion, is it not to the interest of all railway employees that the railways should be as economically and efficiently operated as is reasonably practicable? Is it not to the interest of all workingmen that all industrial processes should be as efficiently and economically performed as is reasonably practicable? We will all agree that it is undesirable, in the pursuit of industrial efficiency, to so speed men up or to require them to work such long hours that their health will be impaired, or that they will be denied the time and opportunity for reading, for the pleasures of home and social intercourse, and for the performance of their duties as citizens of a democratic country. But, conceding this, is it not to the interest of all employees to work to the *healthy* limit of their capacity and to co-operate with their employers in developing and adopting every method and device that will increase their individual and collective efficiency?

"The answer given by many employees is, in substance, no. The machinist says, in effect, that if each machinist does all he can there will not be enough places for all machinists. The engineman says, in effect, that if he moves as many ton miles per hour as he can there will not be enough employment for all enginemen. If it be true that if all those employed in each craft do all they can there will not be employment for all members of each craft, it must follow that if all the employed workers in the country do all they can there will not be enough employment for all who want to work. This, of course, involves the assumption that at any given time there is only a certain amount of work to be done, and that unless it is equitably divided among all there will be some who can get nothing to do. I read not long since in the official publication of one of the largest railway brotherhoods an article opposing the use of methods, devices and equipment adapted to increase the amount of work done by each shop employee and the number of ton miles of freight handled by each train crew on the express ground that these things tend to cause unemployment.

"Now, if it could be shown that the use of methods and machinery that enabled each worker to turn out a larger product, whether that product were corn or manufactures, or ton miles, did tend to injure the workers as a class, either by increasing unemployment or in any other way, we all ought to oppose the use of such methods or machinery. Industry exists for men, not men for industry; and whatever in any industry is injurious to those employed in it should not be tolerated unless it can be clearly shown that the compensating benefits it confers on the employees and on society as a whole exceed the harm that it causes. But is it true that increased industrial efficiency does tend in any way to injure working men, except in very exceptional, temporary and isolated cases? What do men

work for? Not for money, but for the things that money buys—food, shelter, raiment, and so on. And what must be the effect of limiting the amount of work that men do? Obviously, it must be to limit the total amount of things that are produced and that can be consumed. What, on the other hand, must be the effect of increasing industrial efficiency? Obviously, it must be to increase the amount of the things that are produced and that can be consumed. Does increased production and the possible increased consumption that results from it do harm?

"If it were true that the greater the amount of work done by each person who was employed the more unemployment there would be and the worse off the working classes would be, we would find the least unemployment and the highest state of welfare among the workers in those countries where the individual efficiency of labor is the least. On the contrary, it is in countries where the individual efficiency of labor is the greatest that we find the least unemployment and the highest state of welfare among those who work with their hands. The industrial efficiency of a nation is made up of all the individual efficiencies of all its people; and you cannot get the greatest national industrial efficiency if you limit the individual efficiencies. On the contrary, that way lies national and individual industrial and commercial disaster and penury.

"If you go among the employees of railways or any other class of working men and present this argument you may be answered that the demonstration is conclusive that an increase of production accomplished by an increase in the quality and quantity of work done by each employee would be beneficial to all if the increased product were equitably divided, but that the trouble would be that the increased product would not be equitably divided—that the lion's share, or all of it, would be appropriated by the capitalist class. But the question of the division of the product is a question of distribution, not one of production. Limiting what is produced merely limits the amount that there is to be divided, and clearly brings no nearer the 'social justice' which cries out for an equitable system of distribution. The workers are able now, and always will be able to get just as equitable a division of a large product as of a small product. Therefore, it is to their interest, while seeking by every lawful and honest means to get a fair division of what is produced, to also exert themselves to the healthy limit of their capacity to make the amount produced as great as practicable. A fairer distribution of golden eggs will never be produced by killing the goose that lays them.

"There is another aspect of this matter as it relates especially to railways and their employees which is not often considered. The fact is recognized that the public authorities should deal fairly with railways and with their employees in regulating the railways. The fact is also recognized that the railway is a public service corporation and that, therefore, its owners and you and its other officers owe high and peculiar duties to the public. But, as I have already said, the engine-man, the switchman and the track laborer are just as much, and no more, employees of the railways as are its president, its general manager and its traveling engineer. Therefore, every employee of a railway, merely because he is an employee of a railway, also owes high and peculiar duties to the public which are similar to and supplement yours. One of the duties of the officers is to endeavor to operate the properties as economically and as safely as practicable in order that the transportation sold to the public shall be as cheap and safe as practicable. But you cannot do your work satisfactorily and effectively unless you are given the earnest and hearty co-operation of your subordinates; and it is, therefore, the duty of every railway employee to give to the officers, and, through them, to the company, and, through it, to the public, the best service that he can. For employees individually or

collectively to seek to interfere with the development of railway efficiency to the very highest point is, therefore, unfair, not merely to their superior officers and to the company, but to the public, for, in the long run, the effect must be to increase the cost and impair the quality of the transportation rendered to the public. The employees have a right to demand good wages. They have a right to demand the adoption of methods and appliances that will protect them while they are at work. But they have no more right than the owners and officers of the railways by any act of omission or commission to hinder the most economical and efficient operation.

"The education of the railways regarding their duties to their employees and the public has progressed rapidly in recent years. Doubtless by constant efforts on the part of those who appreciate the rightful position of the railway in industry and commerce the public will also be educated to a better understanding of its duty to the railways and their employees, and, by similar means, the employees will be educated to a better understanding of their duty to themselves, to the railways and to the public. While, therefore, we cannot reasonably hope that the employees, the railways and the public will ever exactly appreciate and fully perform their duties to each other, we can at least reasonably hope for and expect changes in their attitudes and relations all around which will be mutually and greatly beneficial to them all."

PRESIDENT HAYES' ADDRESS

"No greater problem confronts any local officer upon any division of the railways in this country today than that which rests on your shoulders. The greatest operating problem of the times is yours. It is your duty to make locomotives haul every ton of freight one mile at the lowest possible cost for repairs, fuel, lubricating materials, tools, and other supplies. On this factor the cost of performing every operation that enters into plans of any magnitude on any railway in this country is founded.

"It will thus be seen that the chief factor in securing results in locomotive operation is the ability on the part of the supervising officer in charge of this work, first, to so train himself that he will be able to impart such instruction to engineers and firemen in regard to this problem that they will see clearly just how, where and when the different savings can be made; second, to follow up systematically all educational lines by practical demonstration, and to keep engine crews fully alive to the subject; third, to stimulate their interest by periodical class meetings in which new phases of the subject may be discussed—in other words to point the way in every conceivable way in order that the operation of locomotives may be made not only economical, but attractive; fourth, to arouse on the part of the engineers and firemen friendly competition in regard to the result of their individual performance of which proper detailed record should be kept; and lastly, to teach all engineers that there is a language which the locomotive speaks and which every engineer, worthy of the name, readily understands, for every piece of apparatus about the locomotive has its voice of contentment, or wail of protest. Hence, the ability to understand and appreciate that language fully, cuts a large figure in economical locomotive operation.

"These principles properly worked out are the only positive way to improve the service rendered. Keeping diligently at it so that results will flow in a progressive and permanent way, remembering at this time one thing which in itself is quite important; namely, that this city, as well as many others, is expending considerable time and money in developing anti-black smoke ordinances, it is more than ever important that greater care and skill than ever be practiced in the operation of locomotives so as to minimize the amount of black smoke. As a guide to better the firing of locomotives the skilful engineer and fireman can do much toward the prevention of black

But one complete report was submitted in reply to the request for the cost of treating feed water. This was from the Santa Fe. The accompanying table gives the average costs for the different divisions:

Station.	Grains of Incrustants.			Lbs. incrusts. removed		Total lbs. incrusts. removed.
	Before treat.	After treat.	Re-moved.	per 1,000 gals.	Cost per 1,000 gals.	
Illinois Div.	29.2	3.6	25.6	3.65	.0313	972,193
Missouri Div.	25.7	4.4	21.3	3.04	.0210	470,463
Kansas City Div.	20.7	4.8	15.9	2.27	.0230	595,491
Eastern Div.	28.4	4.0	24.4	3.48	.0282	1,073,922
Middle Div.	36.9	4.3	32.6	4.65	.0444	1,100,651
Oklahoma Div.	34.3	4.3	30.0	4.28	.0319	808,954
All Eastern Lines.	30.8	4.2	26.6	3.80	.0298	5,021,674
Western Div.	33.8	2.9	30.9	4.41	.0425	654,506
Arkansas River Div.	52.4	3.6	48.8	6.97	.0553	1,596,271
Colorado Div.	47.8	3.5	44.3	6.32	.0231	894,667
New Mexico Div.	42.9	4.3	38.6	5.51	.0186	1,006,544
Rio Grande Div.	24.3	4.1	20.2	2.88	.0311	648,573
Pan Handle Div.	42.4	3.3	39.1	5.58	.0432	427,695
Plains Div.	31.4	4.2	27.2	3.88	.0182	41,853
Pecos Div.	39.2	3.8	35.4	5.05	.0611	956,886
All Western Lines.	38.9	3.7	35.2	5.02	.0375	6,226,995
A. T. & S. F. Proper. .	34.9	3.9	31.0	4.42	.0336	11,248,669
Albuquerque Div.	34.1	4.2	29.9	4.27	.0393	1,152,635
Arizona Div.	25.0	3.2	21.8	3.11	.0257	1,271,690
Los Angeles Div.	23.6	2.5	21.1	3.01	.0274	1,042,723
Valley Div.	22.6	2.9	19.7	2.81	.0261	171,916
Coast Lines.	26.3	3.2	23.1	3.30	.0297	3,638,964
A. T. & S. F. System—						
1911.	30.6	3.5	27.1	3.87	.0324	14,887,633
1910.	31.6	3.6	28.0	4.00	.0318	15,284,164
1909.	35.4	3.7	31.7	4.52	.0332	13,063,320
1908.	35.8	3.9	31.9	4.55	.0346	11,102,859
1907.	32.6	4.3	28.3	4.03	.0355	9,579,772
1906.	35.0	4.1	30.9	4.41	.0361	7,906,233

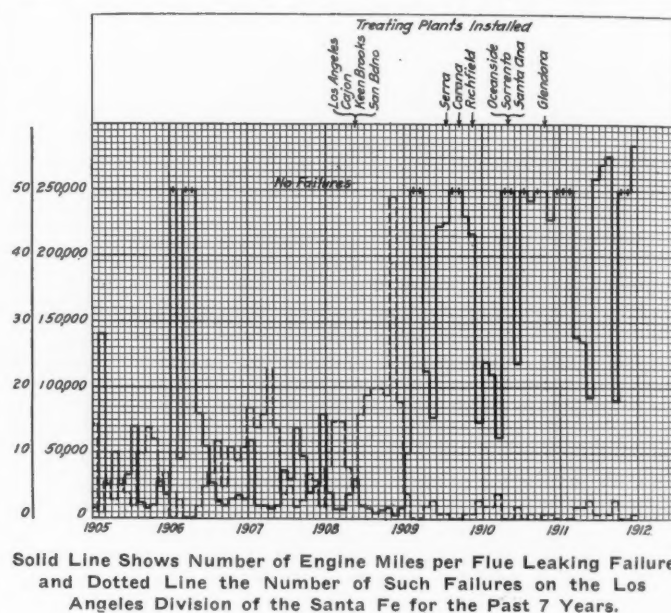
The conclusions from the answers to the questions in connection with the mileage of flues and fireboxes before and after treatment of feed water show that an increase in mileage of from 78 per cent. to 150 per cent. is being obtained where the water is handled in treating plants. Equally good results followed the use of anti-scale chemicals in the tenders. Following is the report of the Santa Fe on this feature:

"Since the adoption of our water treating system the mileage of fireboxes and flues has been doubled and trebled. One of the best examples is the Los Angeles division. In the latter part of 1905, eight large Pacific type oil-burning, passenger locomotives went in service on that division, and up to December, 1907, each of these locomotives had received a new firebox, six of them had received three sets of flues, and the other two, two sets; the average mileage of all fireboxes was 66,064, the lowest 62,452, and the highest 81,608. The average mileage per set of flues during this period was 25,167. There are mountain grades on which helpers are used. The work performed by these engines is heavy fast passenger service, and a very large part of the division is 1 per cent. grade. Shortly after these engines received new fireboxes, or in the latter part of 1907 and the beginning of 1908, a number of water treating plants were installed and three other plants were installed in 1910, consequently some of the locomotives made considerable mileage with the second firebox before the installation of the water treating plants was completed. There are no serious defects in those boxes yet, and they have up to January of this year given an average service of 168,589 miles, and are still going; the flues have given an average service of over 44,000 miles, an increase in flue mileage of 78½ per cent.

"The accompanying diagram shows the flue performance of all classes of boilers on the Los Angeles division for the last eight years, which includes the performance of the eight passenger locomotives previously referred to. You will note a constant improvement, notwithstanding the increased work demanded of the locomotives; this improvement seems to keep pace with the improvement in the condition of the feed water.

"We use treated water to prevent incrustation, and give credit

for the prevention of incrustation and improvement in the performance of our fireboxes and flues to the system of treating water. We use an anti-foaming treatment to prevent foaming, both with our treated water and in territories where the water is not treated, which does the work very satisfactorily, eliminating all of the troubles due to a foaming boiler, reducing the cost of fuel and lubrication, and enabling us to handle tonnage that it would be impossible to handle otherwise. In territories where the water is not bad enough to warrant the installation of treating plants, but does give trouble with foaming, we find that anti-foaming preparations have a favorable effect in preventing incrustation as well. It is but just and fair to a water treatment that counteracts or prevents foaming, to give it credit for



adding to the life of the firebox and flues, on the theory that when it prevents foaming it keeps the water in a more dense condition, so that it absorbs more readily the heat that is passing through them, and by so doing prevents their overheating and consequent damage."

Other conclusions reached by the committee were that treated water increases the tendency to foam; that anti-foaming chemicals are successful; that treated water does not increase the mileage between washouts; that the efficiency of the locomotive is increased by the use of treated water, especially if used in connection with an anti-foaming treatment; that the increased foaming of waters treated for scale increases the cost of maintenance of the locomotive; that blow-off cocks should be freely applied and used, that their operation should be convenient and that the frequent use of blow-off cocks for short intervals is better than longer openings at long intervals. The committee stated that soda ash is beneficial in waters where the encrusting solids are heavy and the alkali salts light.

Committee:—F. McArdle, chairman; George Austin, W. S. Reid, W. H. Wallace, Wm. Daze, W. D. Cooper and T. F. Lyons.

DISCUSSION.

The discussion was confined principally to the treatment of water by chemicals introduced in the locomotive tanks, or direct to the boiler. Some trouble was reported with the use of soda ash in superheater locomotives causing a deposit on the inside of the small superheater tubes. A. M. Bickel stated that the use of soda ash on these locomotives had been discontinued on the Lake Shore & Michigan Southern. F. P. Roesch (El Paso & Southwestern) explained that unless the blow-off cocks were opened frequently or an anti-foaming compound was used, soda ash would cause a deposit of scale in the superheater. He

had found it difficult to get the enginemen to use the blow-off cocks as frequently as desirable, but had had excellent results from the use of an anti-foaming compound. Other members testified to the success of the anti-foaming compound, but all agreed that the proper use of the blow-off cocks would have a decided effect on a foaming condition, and even where the compound was used blowing down should not be neglected.

The cost of the treatment in the tender appears to be from three to ten cents a thousand gallons, depending on the quality of the water. The anti-foaming treatment costs from one and one-half to two cents a thousand gallons.

Replying to a question Wm. Daze (Santa Fe) explained that bottom blows were used instead of surface blows to overcome a foaming condition, because the chemicals causing the foaming settle to the lowest point. This is especially true where a compound is added to overcome the foaming. One member reported that the enginemen on his division had found castor oil to be effective in reducing foaming.

The mileage between washouts is increased where the water is treated at wayside tanks, and decreased when chemicals are introduced in the locomotive tank. Frequent blowing down in the latter case will tend to increase the time between the washouts. Blow-off cocks should not be used when the injector is working.

One member reported on an experiment with settling tanks to remove the sediment in dirty waters. The results were a complete failure, although the equipment was extensive and most carefully designed. It was reported, however, that the Santa Fe is now building some tanks for this purpose.

The discussion as a whole indicated the complete success of treating feed waters by the introduction of compounds direct to the tender tank, if blow-off cocks are applied and used. This applies to both scaling and foaming waters.

RELATION OF MECHANICAL APPLIANCES TO FUEL ECONOMY

The only object in burning fuel is to obtain from it the stored-up energy and utilize this energy to produce motion. This being the case, any device or mechanical appliance that will enable us to obtain more energy from a given amount of fuel, or to utilize, by converting into work, a greater part of the energy contained, must be classed as a distinct factor in the fuel problem. The percentage of economy, due to any mechanical device, can be calculated by the increased amount of work obtained from a given quantity of fuel; and as work in this instance means motion, the time element must enter in the problem. Therefore, to get the true measure of economy for any mechanical device, the work must be measured, not in train or engine miles, but in ton miles per hour. The relation of any mechanical appliance to fuel economy would, therefore, be in proportion to the decrease in fuel consumption per mile in hauling the same tonnage at the same speed; to the increase in speed with the same tonnage on an equal amount of fuel per mile; or to the increased tonnage hauled at the same speed on the same consumption of fuel per mile run.

Viewing the proposition from this standpoint, there is no question but that of all mechanical appliances the high degree superheater stands pre-eminently at the head. The most comprehensive and carefully conducted tests carried out in this country, with a view to obtaining definite data bearing on the fuel economy due to the use of superheat were made by the New York Central, in connection with the Pennsylvania Railroad in 1910.* The final results of these tests are shown in the following table, in which it is seen that the saving in fuel due to superheat (allowing 2.3 per cent. as due to improved circulation of the arch tubes) was equal to 26 per cent., while the total saving due to the installation of a brick arch and a superheater was equal to 33.3 per cent. This test also shows

that the application of the brick arch resulted in a net saving in fuel of 7.3 per cent.

A series of tests, conducted by the chairman, covering a period of several months, showed that the increase in fuel economy is proportionate to the increase in tonnage, which proves the theory that the efficiency of a superheater locomotive is proportionate to the increase in superheat, and the degree of superheat depends on the rate of combustion; the

DRY COAL PER DYNAMOMETER H. P. HOUR.			
Speeds.	Saturated Steam, No Arch.	Superheater.	Superheater and Brick Arch.
12.5	4.67	3.15	2.90
15.0	4.75	3.56	3.25
17.7	4.69	3.40	3.27
Average	4.70	3.37	3.14
Relative Coal Consumption...	100	71.7	66.7

rate of combustion being necessarily higher when handling an increased tonnage at the same rate of speed. The final results checked very closely with the results found on the New York Central and the Pennsylvania.

Undoubtedly, next in order, as a mechanical appliance affecting fuel economy, is the brick arch, although the feed water heater runs it a close race and in some instances precedes it. The value of the brick arch as a fuel economizer is due (where arch tubes are used to support it) to the increased heating surface of these tubes, and to the better utilization of the firebox heating surface.

No better illustration of the method by which the application of the brick arch utilizes the full firebox area to the best advantage can be given than that shown in the article contributed to the February, 1912, number of the *American Engineer*, by F. F. Gaines, superintendent of motive power of the Central of Georgia, from which the table on the following page showing the results of several tests is taken.

It will be noticed that by a change in firebox construction and the substitution of a vertical hollow wall, an even greater fuel economy is effected, and there is no question but that if this type of firebox was used in connection with a high degree superheater, a greater per cent. of the energy now unavoidably lost in the present type of locomotive would be conserved.

The economical value of the brick arch depends on the type of boiler, the relation between the firebox heating surface and the tube heating surface, the nature of the fuel and character of the service, and it is due to the failure to take into consideration the above essentials that so many widely varying results are obtained, and so many different opinions find credence for and against the value of the arch. Facts are stubborn things, however, and as repeatedly verified tests can be taken as facts, we can safely assert that in the majority of the present-day locomotives the intelligent application of a correct brick arch will result in an economy of fuel ranging from 5 to 15 per cent.

Among other mechanical appliances tending toward fuel economy, the feed water heater must not be overlooked. Prominent among the successful types are the Buck-Jacobs, as used on the Santa Fe, and the Gaines, used on the Central of Georgia. Personal observations, made by the chairman, as to the efficiency of the former, proved that the temperature of the feed water was increased 75 deg. This multiplied by the number of pounds of water heated will give the saving in heat units, and this product divided by the number of heat units obtained in the firebox from each ton of fuel would represent the fuel saving. No absolute data on this particular subject is available, however, but various estimates have placed the feed water heater, where the temperature is raised 50 deg., or more, as being equal to from 8 to 12 per cent. in fuel economy.

While the mechanical stoker has a bright future ahead of it,

*See *American Engineer & Railroad Journal*, December, 1911, page 470.

and will unquestionably, when perfected, be applied to such locomotives as consume an amount of fuel beyond the physical capacity of the fireman to handle, yet as a fuel economizer *per se*, the committee is not prepared to go on record with any definite statements. Although many tests have indicated that an economy in the amount of fuel per ton mile per hour has frequently been obtained with the different types of stokers, yet other tests have shown contrary results, thereby still leaving the question of economy in pounds of coal somewhat in doubt, but when calculated on the basis of cost per pound of coal, the balance is in favor of the mechanical stoker, as tests have proved that by means of this appliance a cheaper grade of fuel can be handled successfully. The committee is prepared to go on record, however, to the effect that on large engines, which tax the ability of the fireman to the utmost, the application of a successful mechanical stoker will result not only in an increased efficiency of the locomotive, but also in a measure of fuel economy after the enginemen become sufficiently familiar with it to handle it intelligently.

There are several other mechanical devices, such as mechanically operated fire-doors, grate-shakers, coal-passers, etc., that have a direct bearing on the fuel problem, but in the absence of any authoritative data on the efficiency of any of these

ture, however. The fact that there is a smaller quantity of steam being exhausted and that it escapes at a higher velocity would evidently demand a smaller nozzle.

Superheaters on switch engines is a late development that attracted considerable interest. Members that have had experience with such locomotives reported them to be surprisingly successful. One speaker reported a saving of 50 per cent. in fuel and an increase of one-third in the amount of work performed. On the Lake Shore & Michigan Southern the dampers in the front end have been removed from superheater switching engines with no apparent disadvantage.

Stokers.—Clement F. Street was called on and briefly reviewed the development of locomotive stokers during the past year. He stated that the stoker was now positively out of the experimental stage and was as reliable as any piece of machinery could be. There are now 175 Street stokers in service or on order. The greatest development of the past year has been the appreciation of the necessity for regular attention and inspection of stokers at the terminals. This feature is now fully understood and every stoker is inspected and lubricated before the locomotive goes out on its run, with the result of a practical elimination of stoker failures on the road.

Engine Number.	Train Number.	Date.	Actual Time Consumed.	Stops.		Pounds coal consumed.			Pounds water evaporated.		Miles run to one ton of coal.	Tons coal used in excess, based on Engine 1014 as unit of comparison.	Relative efficiency based on coal consumption per mile.
				Number.	Time Consumed.	Total.	Per 1,000 ton miles.	Per hour	Total	Per pound of coal.			
*1014	Extra	1/13/11	6 hr. 34 m.	6	1 hr. 4 m.	11,950	93	1,820	96,800	8.10	16.74	.....	.....
	2/36	1/14/11	6 hr. 42 m.	8	1 hr. 33 m.	13,350	104	1,991	109,000	8.16	14.98	.....	.....
1014	3/37	1/16/11	6 hr. 12 m.	7	49 m.	12,450	97	2,008	105,750	8.49	16.08	.....	.....
	1/36	1/17/11	6 hr. 39 m.	7	1 hr. 12 m.	14,250	111	2,143	109,800	7.71	14.04	.....	.....
....	....	.....	26 hr. 7 m.	..	4 hr. 38 m.	52,000	101	1,991	421,350	8.10	15.38	.....	100.00
†1012	Extra	1/18/11	7 hr. 12 m.	5	57 m.	20,400	159	2,833	121,458	5.95	9.80	.....	.....
	1/36	1/19/11	8 hr. 4 m.	5	1 hr. 16 m.	21,900	170	2,715	124,887	5.70	9.13	.....	.....
1012	Extra	1/20/11	6 hr. 43 m.	5	45 m.	19,087	148	2,841	113,095	5.93	10.48	.....	.....
	2/36	1/21/11	7 hr. 20 m.	8	1 hr. 43 m.	22,500	175	3,068	121,883	5.42	8.89	.....	.....
....	....	.....	29 hr. 17 m.	—	4 hr. 41 m.	83,887	163	2,865	481,323	5.74	9.54	15.94	61.96
§1716	Extra	1/23/11	8 hr.	9	2 hr. 33 m.	15,000	117	1,875	110,400	7.36	13.33	.....	.....
	1/36	1/24/11	7 hr. 24 m.	10	1 hr. 41 m.	16,500	128	2,230	120,000	7.27	11.43	.....	.....
1716	Extra	1/25/11	6 hr. 50 m.	9	1 hr. 20 m.	13,800	107	2,080	102,801	7.45	14.49	.....	.....
	1/36	1/26/11	7 hr. 28 m.	12	1 hr. 42 m.	15,600	121	2,089	117,166	7.51	12.82	.....	.....
....	....	.....	29 hr. 42 m.	..	7 hr. 16 m.	60,900	118	2,050	450,367	7.39	13.14	4.45	85.58

*Engine 1014—21 in. x 32 in. Cooke consolidation—with new firebox and combustion chamber, with hollow brick wall and provision for mixing hot air with burning gases. Total heating surface, 2,987.33 sq. ft.

†Engine 1012—Same class engine as 1014, but with original boiler unchanged, and brick arch. Total heating surface, 3,022.29 sq. ft.

§Engine 1716—22 in. x 30 in. Baldwin consolidation—brick arch. Total heating surface, 3,230 sq. ft.

Analysis of fuel: Moisture, 1.39 per cent.; volatile combustible matter, 30.56 per cent.; fixed carbon, 55.11 per cent.; ash, 12.94 per cent.; sulphur, 1.5 per cent. B.t.u. per lb. dry coal (Mahler Atwater calorimeter), 13,179; B.t.u. per lb. actual coal, 12,996.

appliances in this respect, the committee would prefer to have the relative economies of them brought out in the discussion on the floor.

Committee:—F. P. Roesch, chairman; Dan Daley, F. R. Scott, Y. S. Merriman, D. J. Madden, G. E. Spangler and G. M. Carpenter.

DISCUSSION.

Superheaters.—The subject of superheaters was first placed before the meeting for discussion and the remarks of the members indicated that the service of superheater locomotives is so uniformly successful as to offer very few features for discussion. Such test results as were quoted showed the reported figures to be correct and the comment of the speakers showed that no difficulties of any importance have developed. There was some question as to the proper size of nozzle to use on a superheater locomotive that had been converted from a saturated steam locomotive. It was finally explained by a representative of the Locomotive Superheater Company that if the size of the cylinders had not been increased, the nozzle would have to be decreased. There is no set rule on this fea-

Mr. Street stated that there were no test figures available as to fuel economy, but that he hoped to have complete tests in the near future. He explained, however, that present service indicated that the amount of coal per engine mile and per ton mile would be decidedly increased, but that the amount per ton mile per hour would be less. Stoker locomotives are worked to their greatest capacity all the time and handle larger trains at higher speeds. There was no discussion.

Brick Arches.—The president called on Le Grand Parish, president of the American Arch Company, for a report of the progress in the use of arches during the past year. Mr. Parish stated that 85 per cent. of the new locomotives are fitted with brick arches. In 1907 but 25 per cent. had arches. He said that the most important recent development toward improved combustion was the use of the combustion chamber, particularly the design developed by F. F. Gaines, superintendent of motive power of the Central of Georgia. As an instance of what can be expected in this direction he said that the very large Mallet locomotives for the Virginian, which have a tractive effort of 115,000 lbs., were estimated to require 9,000 lbs. of coal an hour to give their full power. It was found,

however, that, principally on account of the application of the Gaines combustion chamber, they consumed but 7,500 lbs. of coal an hour at full power.

Mr. Parish stated that the tests by Dr. Goss at Coatesville showed an increase of 8 per cent. in the amount of water evaporated per pound of semi-anthracite coal and of 12 per cent. with bituminous coal.

Replying to a question, the speaker explained that the quality of the fuel would determine whether the arch should be tight to the flue sheet or not. In 85 per cent. of the applications it is set away from the sheet from 5 to 6 in. The openings are larger at the corners than at the center.

The value of the circulation in the arch tubes was explained to vary in relation with the distance from the upper end of the tube to the surface of the water. It is now the practice to place the back end of the tubes close to the crown sheet.

MR. WORTHINGTON'S ADDRESS

B. A. Worthington, president of the Chicago & Alton, accepted an invitation to address the convention, and spoke, in part, as follows:

There is no position in the railway service where more effective work can be done than in the position of traveling engineer, and no position that can bring about more economy than from the head end of a train. Very much good can be done on the part of traveling engineers, especially by instructing firemen to properly perform their duties, as the average fireman can save his wages every trip over the road through proper fuel economy.

Much good can be done by instructing the engineers to use careful judgment in starting trains, and in forcing them to speed, and in moving them between stations with as small consumption of fuel as is consistent with necessary speed and time requirements. Also in instructing the engineers in the proper use of the steam in the cylinders. Boiler feeding is quite as important for fuel economy as the right use of steam. While engineers should maintain a nearly steady steam pressure, they should permit liberal variations of the water level within safe limits to save fuel.

Firemen should be instructed that the blowing of pop valves wastes usually about a shovelful of coal per minute, or a lump of coal as large as a lemon every second, and that the avoidance of popping will save considerable of their energy and at the same time save dollars for the company.

Another thing comes to my mind suggestive of how the traveling engineers can do much good, not only for themselves, but for the benefit of their fellow workmen. As is well known, there is prevailing among the laboring classes generally throughout the country a spirit of unrest manifesting itself through strikes of the various crafts and demands for higher compensation, until the employers have reached a stage where they find themselves unable to grant further concessions and maintain the solvency of their properties. Yet labor in all lines of service has never been better paid, and the working conditions have never been less arduous in this country than they are at the present time.

In your daily association with men in the service, think of the influence for good which you might exercise if you would but make the effort. Half of the troubles of these men come through ignorance—ignorance which is fostered by various societies and by labor leaders who are supported and aided by newspapers through the dissemination of socialistic literature. In fact, there seems to be a yellow fever of literature prepared for the spread of incorrect information, which is misleading to the men who have not the chance or opportunity to get at the facts to enable them to take a broader view of things. Soon the men who fall under the baneful influence become unable to distinguish between the right and the wrong. Naturally, they develop a morbid thirst for sensational printed matter, and the more they read the less they learn.

Men in your position who are able to look on both sides of

the problem, should speak out plainly and do everything possible that will work as an antidote to these dangerous influences. What I am pleading for is the wider, nobler, unpaid-for service which conservative men are able to render to society, simply by being thoughtful and helping other men to think, thereby exploding wild and impracticable theories and bringing them out to the test of reason, obstinately opposing all rash experiments.

We should not forget that the existence of many of our fellow-men is along dark, confused and bitter lines. Some are groaning under the burden of want, partly because of their own idleness or incapacity, or partly because they are following the socialistic doctrine that they are entitled to a life of ease and pleasure at the expense of somebody else; some because of the greed and injustice of other men; and some because of the lack of proper guidance and of good counsel and human sympathy.

The question naturally arises to each and every one of us as to how best to meet this situation. Manifestly, if we take a negative position no good will be accomplished. Our influence, to be felt, must be positive and along unmistakable lines. All reactionary sentiment and false standards should be rebuked by those of us who are able to explain the fallacy of such dangerous doctrines. There is a loftier position than merely to stand high in the world, which can be attained by stooping to help your fellowman to a higher moral plane; by fearlessly pointing out the pathway of truth, purity and righteousness, which will certainly result in the greatest good to the greatest number, and what we need today is a larger number of men who will not hesitate to stand for the right and declare in unmistakable terms their honest convictions against the evils that are present on all sides, and the wild theories that are being exploited among the laboring classes today, causing so much socialistic unrest and labor trouble.

It should be remembered that decay begins in discord, which is simply a loss of balance in an organism because one part of the system gets more than its share of sustenance and the other part too little, and if the process is continued, destruction is inevitable.

The traveling engineers could do much good by conservative action, in softening and ameliorating unavoidable inequalities of life which have existed since the world began, and by striving to change the feeling of jealous hatred against the more fortunate ones into a feeling of generous fortitude and hospitality, endeavoring to keep the relations between man and man and between class and class in a healthy condition for the benefit of society as a whole.

If the traveling engineers of the country will work along these lines, much good can be accomplished, and their splendid services in this way will tend to offset the socialistic sentiment which seems to promise to men of limited understanding a life of ease and comfort through legislative enactment and through the coercive forces of union labor, regardless of the industry, frugality and merit of the individual.

HANDLING LONG TRAINS WITH MODERN AIR BRAKE EQUIPMENT

The control of slack in passenger and freight trains is an important factor in successful handling; in freight trains this item is affected by so many variable conditions that a hard and fast rule for its control is impossible. The slack action is affected more by unequal braking power than by any other single item, and it has been very aptly said by W. V. Turner, in a paper before the Western Railway Club, that "the operation of the brake is according to fixed laws and conditions over which the engineer, of all men, has the least control," and still it is on the engineer that the responsibility rests for the proper handling of trains. With all these variable conditions to be met, his success fundamentally depends upon the use of proper judgment, the ability to grasp and analyze conditions as they arise, and to select the general rule of operation of the brake that will cover the situation with the least shock and danger.

To make the handling of long trains successful it will be necessary to have the co-operation of both the transportation and mechanical departments, the former interested in the make-up of trains and the latter in the maintenance of equipment. When shorter trains were general and comparatively light power was used, the make-up of a train was not given special consideration, nor was it essential that it should be, but when you consider that in the ordinary 100-car train there is over fifty feet of slack, the energy stored in a moving loaded train (especially when concentrated at any one point) is terrific.

To give some idea of the effect of unequal braking power in a long loaded train, we call attention to tests made on the Chesapeake & Ohio. The train consisted of a Mikado engine, dynamometer car, wooden underframe coach, one hundred loaded steel cars and a caboose. The gross weight, exclusive of engine, was 6,592 tons. The train was moving at a speed of twelve miles an hour on level, straight track, with the steam pressure on the engine down to eighty pounds. The engine was equipped with two No. 5 New York pumps and "LT" equipment. The brake pipe pressure had gradually fallen from seventy to sixty pounds, when one of the triples near the head end went to quick action, but quick action did not carry through the entire train, as the brake pipe recording gage on the caboose showed a seven-pound service reduction. A buff was recorded on the dynamometer car of 830,000 lbs. and the drawhead was driven up and the Farlow attachment stops sheared off on the fifty-ninth car. The quick action probably carried close to the fifty-ninth car, causing the head end of the train to stop and the slack running up in the rear portion caused the shock.

On another run with a Mikado engine ascending a .3 per cent. grade with eighty-five fifty-ton steel cars, 6,025 gross tons, and being pushed by a helper, the train was moving at a speed of eleven miles an hour, when the air hose burst on the fourth head car, causing a buff of 610,000 lbs. on the dynamometer car and breaking down the drawhead and draft sills on the twenty-first car from the leading engine.

The same condition is true, only in a lesser degree, when the slack is run in rapidly with a heavy service application of the brakes, and it is of the greatest importance that the equipment be kept in the best possible condition, the adjustment of piston travel uniform, the brake cylinder leakage kept to the minimum, and that the enginemen be instructed as to the proper methods of handling.

With the improved equipment that has been put in service recently, the success of handling the long train depends chiefly on how the equipment is operated. By long trains we mean eighty-five cars or over. We would in no case recommend that more than a seven to ten-pound initial reduction be made, and as far as possible that that reduction be allowed to stop the train. When within fifty to seventy-five feet of the stop another reduction should be made, so that the brake pipe will be exhausting when the train comes to a stop. The latter reduction is made to keep the slack bunched and to leave the train in a good position for starting. When a stop can be contemplated far enough in advance, the throttle should be closed gradually, and the train allowed to drift before an application is made, so as to allow the slack to assume its normal position and bunch slowly, for in the case of the large engines the internal resistance will very readily bunch the slack when the engine is shut off. In every case where the train consists of loads on the head end and empties on the rear the application should be begun before the engine is shut off, keeping the train stretched as far as possible, otherwise when the brakes take hold on the rear, the slack will run out rapidly, due to the excess braking power concentrated on the rear, with a tendency to part the train.

In all air brake operation the chief factor is the time element, and this governs either when applying or releasing the brakes. The ideal method of controlling the slack in long trains would be to cause the serial operation of the brake on each car rapidly

enough to make each car do its braking and at the same time equalize the retarding force of each car, but as a rule with a long train the stop is completed before the brakes on the rear of the train are effectively set, and while the time element is reduced by the introduction of the quick service triple, it is still an ever-present factor and one which both the air brake companies are trying to overcome by the use of the electro-pneumatic and load-and-empty brakes, which are in process of development.

When releasing the brakes, the time factor becomes of greater moment so far as the serial operation of the brake is concerned, and where an effort is made to start long, heavy trains before the release of the rear brakes the danger of parting is as great as when stopping trains. After coupling up at water or coaling stations, or after a full service application has been made, we recommend that the enginemen be instructed to place the brake valve handle in full release position not longer than fifteen seconds and then return it to running position, and that no effort be made to start the train until one minute has elapsed with fifty cars or less, and with trains of over fifty cars two minutes additional be allowed for every twenty-five cars over fifty. For instance, three minutes should be allowed for seventy-five and five minutes for one hundred cars. This is to be independent of the pump capacity, for the length of time required to release the brakes depends on the time required to build the pressure up on the rear of the train, which is entirely controlled by the frictional resistance of the brake pipe. When releasing the brakes in all cases we recommend the "kick-off" to release such brakes on the head end as may have re-applied.

The successful handling of freight trains depends on the condition of draft rigging, piston travel, brake cylinder and brake pipe leakage, all of which is dependent on the thoroughness of terminal inspection.

Yard test plants should be installed at all terminals, brakes put in serviceable condition, and brake pipe leakage determined before the engine couples to the train. The amount of brake pipe leakage permissible is determined by the length of the train, but it must be remembered that brake pipe leakage is beyond the control of the engineman, and on the amount of leakage depends to a great extent his ability to handle the train successfully. The maximum amount of leakage determined on by a certain large system, that is operating long trains successfully, is as follows: Eight pounds for trains not to exceed twenty-five cars, seven pounds for trains up to fifty cars, six pounds for trains up to 75 cars, and five pounds for all trains over 75 cars.

The make-up of trains is determined largely by local conditions, such as yard facilities, classification, character of lading and types of cars; however, upon the make-up of the train also depends the ability of the engineman to successfully handle it to avoid break-in-two shocks and shifting of lading. While it is considered impractical to alternate loads and empties, some effort should be made to equalize the braking power of long trains as affected by loads and empties or light and heavy loads, such as coal and merchandise. This can be done to some extent by distributing the lights and the loads in cuts throughout the train, rather than by placing the loads ahead and empties behind, as is the common yard practice. One of the most prolific causes of break-in-twos is the improper handling of cars on hump yards and failure to make thorough inspection to determine the condition of the cars after they have been humped.

Where engines are equipped with large pumps, there has been some doubt as to the ability to stop long trains by the use of the conductor's valve, or where the break-in-two occurs near the rear, and several cases are known where the train proceeded for a considerable distance after breaking in two without any appreciable fall in pressure shown by the gage on the engine; while this is possible where the train has not been charged up, several tests which were conducted on a 100-car train show that by opening the conductor's valve all brakes could be set; the feed valve would release the first ten to fifteen brakes and keep them re-

leased, the remainder of the brakes would remain applied, these tests being conducted with the brake valve handle in running position. Where the train is properly charged, a break-in-two would stop the train; therefore the enginemen should be impressed with the fact that when handling long trains with engines of large pump capacity they should not attempt to start until all auxiliaries have had time to charge. It requires from fourteen to twenty minutes to charge the one hundredth car from zero to seventy pounds. We do not mean to imply that it is necessary to stand still that length of time, but sufficient time should elapse after coupling up, when the engine has been detached for long periods, to give the auxiliaries time to charge up sufficiently, so in case of a break-in-two the brakes would set. It has been the experience of the committee that where trains break in two, proceed and leave the rear section, it usually occurs at water tanks or where the engine has been detached from the train for a considerable length of time and an effort is made to start without waiting for time to recharge. The conductor should be instructed that when necessary to stop the train from the rear, the conductor's valve should be opened wide, without the usual effort to make a service application.

A few general instructions should be given to enginemen, which, together with the use of good judgment, will practically eliminate break-in-tuos. Care should be used not to run the slack in or out too rapidly; the heavier the engine and the longer the train the more care and time should be used. No accurate stops should be attempted; where the engine has to be spotted, such as at water tanks and coaling stations, it should be detached from the train. A light initial reduction should be made and that allowed to stop the train, except that when within fifty to seventy-five feet of the stop another reduction should be made so that the brake pipe will be exhausting when the stop is completed, this to leave the train in a favorable position to start. Straight air should not be used to make stops or to handle trains except when releasing brakes, and then only to assist "K" triples in preventing slack from running out.

When beginning an application, the speed of the train should be taken into consideration. It must be remembered that the retarding force of any given cylinder pressure increases as the speed decreases. When handling long trains on grades, such application should be made as necessary to control the speed of the train, care being taken to prevent overheating of the tires.

On long grades where upward of seventy-five cars are handled and where the character of the grade will permit, it will be found of advantage to turn up about 75 per cent. of the retainers on the head end of the train. This will have a tendency to keep slack from running in and out each time an application and release are made, and this is especially so where light loads or empties are being handled on the rear.

With trains of over seventy-five cars, the brakes should not be released after the speed has reduced below fifteen miles an hour.

When backing long trains, where possible to do so, they should be allowed to drift to a stop; otherwise steam should be used with the locomotive brake released to keep the slack from running out too rapidly.

Handling Passenger Trains.—With the introduction of heavy steel passenger equipment came the introduction of the double "PM" equipment, the "LN" and "J," a little later the "PC," and now the electro-pneumatic brake is being pushed for passenger service.

The double "PM" equipment consists of two separate sets of brakes on each car, a brake for each truck, and has proved more or less unsatisfactory, due to the increase in the volume to be taken care of and the attendant liability of stuck brakes unless the greatest amount of care is used. In ordinary passenger train handling with double "PM" equipment it is necessary that very close attention be given to the condition of triple valves, especially as to the tightness of the packing ring; otherwise unless heavy reductions are continually made, trouble will be experi-

enced with the brake sticking. In instructions to enginemen we recommend that they make no reductions of less than fifteen pounds, the reduction being split, the initial reduction to be six pounds, so as to gradually bunch the slack in the train, that to be followed with a nine or ten-pound reduction before releasing. The brake valve handle should be kept in full release position with over eight cars for at least five seconds. Unless the enginemen will follow these instructions there will be more or less trouble experienced with the "PM" equipment, due to burned-up brakes or slid flat wheels, the explanation being that the heavy load remaining on the slide valves of each triple valve where the pressure is reduced to but a few pounds below standard, coupled with the slow rise in brake pipe pressure requires that the triple valve piston packing rings be a good fit to insure release. It must be understood that if the speed of a train is slow the heavy reduction, if made while moving, will have about the same effect as quick action. A light reduction should be made to stop the train, and after being stopped the brake pipe pressure should be further reduced, so as to insure release.

With either the "LN," "J" or "PC" equipments the best results are obtained by splitting up the reductions, for in long passenger trains the slack action can be made very uncomfortable for passengers. We recommend that in each case the preliminary reduction be from six to eight pounds, and after a short interval the necessary reductions be made to stop the train. It must be remembered, however, that the brakes with these equipments are positive and severe, and care should be taken at slow speeds to prevent wheel sliding. With the "PC" equipment it is necessary to make a seven or eight-pound reduction of brake pipe pressure before the brake applies, the high differential being used so that slight variations in brake pipe pressure, such as would be caused by a sluggish feed valve, will not cause an undesired application.

On account of the large volume of air required for heavy passenger trains, and the various devices on engines operated by air, it is imperative that passenger engines be equipped with two pumps, and they should not have a main reservoir capacity of less than 50,000 cu. in.

Committee: W. F. Walsh, chairman, E. F. Wentworth, W. V. Turner, C. W. Wheeler, H. A. English, and H. A. Flynn.

DISCUSSION.

This subject aroused the most discussion of any of the reports presented at the meeting. It appeared that the trouble with rough stops on long passenger trains and damage to the cars in long freight trains, due to poor handling of the brakes, was quite general, and that there was considerable doubt in the minds of many members as to the proper methods to overcome it. W. V. Turner, of the Westinghouse Air Brake Company, opened the discussion with a very clear and complete explanation of the proper proceeding in braking long trains, and during the two sessions given up to a discussion of this subject, he was called on frequently for further suggestions to suit special cases. It was made clear by Mr. Turner that it was impossible to make rules that would fit all cases. The engineman's judgment must be depended on, as he is the only one who can know the exact conditions. He should be taught to give the time element careful consideration in every case, and should be instructed in principles rather than being given rules to follow.

T. F. Lyons (Lake Shore & Michigan Southern) stated that most of the flat wheels could be avoided by a more careful manipulation of the brakes, which usually means a longer time allowed in making the stop. The success of the two-application method depended on how much the speed was reduced with the first application. If the speed was not reduced to about 20 miles an hour, the second application would not give a smooth stop. He also strongly advocated the cultivating of judgment rather than the teaching of rules. Several other members spoke of the multiple application method not being successful, but it appeared that either the conditions were not normal or that the

speed was not reduced sufficiently, as explained by Mr. Lyons.

The fact that the loaded and empty cars in freight trains are not equally distributed throughout the train was held by some members to be responsible for many bad order cars. This make-up of train was strongly recommended by some speakers, but later in the discussion the fact was made clear that if the tonnage could be increased by grouping the loads ahead, this factor would be of more value than the improved braking qualities. The thing to be done is to learn to handle the trains as they are and not as the engineman would like them to be.

A light application of the brakes before the throttle is closed was reported as being successful, as it permitted the slack to adjust itself without shocks. Here again it appeared that the make-up of the train and the character of the brake equipment would be the determining factor as to the advisability of this practice.

The fact that much damage to cars that is blamed to poor handling of the brakes is really due to rough handling in the yards was mentioned by Mr. Roesch. Damage to cars resulting from treatment in the yards very frequently will not make itself evident until the train is many miles away, when a stop or slow-down that is practically perfect will give the shock needed to release the damaged drawbar. This is especially so with wooden cars when mixed with all-steel equipment.

In connection with handling long passenger trains, Mr. Turner explained that a reduction of not over ten pounds should be made if the speed of the train is less than thirty miles an hour. He explained that different make-ups of train, i. e., how many loaded baggage or mail cars there were at the head end of the train and how many passenger cars and sleepers back of them; the condition of the rail, the speed of the train, the grade and curve conditions, were all factors to be taken into consideration in determining the proper method of stopping long passenger trains. A retarding force of not over $1\frac{1}{2}$ per cent. per second should not be exceeded. Unless everything in connection with the brakes on the train is in good condition it is impossible to make a perfect stop in any case. The electro-pneumatic brake is now being developed to overcome some of these troubles.

The use of the conductors' valve for service application of the brakes was strongly condemned; this valve is for emergency only.

F. B. Farmer, of the Westinghouse Air Brake Company, advised the use of braking methods, suited to the worst conditions, at all times. The so-called split reduction had been found successful in some cases.

In the opinion of one member, rough stops are sometimes due to the fact that the brakes on the locomotive do not release as quickly as do those on the cars.

The uniformity of smooth stops with long passenger trains on the New York Central Lines, which was mentioned by Mr. Turner, was explained by Mr. Kenny, a locomotive engineer on that system, as being entirely due to the attention given the matter by the enginemen. No set rules are followed, and the so-called running test, which consists of a light application, soon after the train is started, is depended on for information as to how to handle the brakes in making a stop.

TRAIN TONNAGE

J. M. Daly, general superintendent of transportation of the Illinois Central, presented a paper on Train Tonnage, of which the following is an abstract:

Admitting that the roads require economy from your department, the next move is to carefully analyze the factors that create train resistance and determine what is necessary to obtain increased efficiency in the loading of trains. To do this, it is necessary to briefly review the methods used in loading trains.

Records show that in 1870 the carrying capacity of freight cars was about 24,000 lbs.; today it is 100,000 lbs., an increase of over 400 per cent. In 1870 the average weight of a car was 16,000 lbs., or 40 per cent. of its capacity, whereas today, a 100,000 lb. capacity car weighs only 40,000 lbs. or 40 per cent. of its

capacity. In 1870 the record shows that trains were made up on the basis of a given number of loaded cars, and if empty cars were in a train they were rated at two empties equal to one load. Later on this was modified and three empties were considered equal to two loads. This was a reasonably accurate basis due to the uniform capacity and loading of cars moved in tonnage trains, but with the adoption of the large capacity cars, the car basis had to be abandoned and the gross ton basis adopted.

About 1895, with the introduction of the large 50-ton capacity coal car, the Hocking Valley found it impracticable to load engines on the basis of the number of cars, as trains with 50-ton capacity cars invariably stalled. This condition necessitated a change, and the gross ton basis was adopted. Immediately on the adoption of the gross ton basis, it was found that an engine rated at 2,100 gross tons when hauling 30-ton capacity cars, gross weight per car 50 tons, had its maximum load with 42 cars or 2,100 tons, whereas the same engine could run away with 30 cars of 70 tons each, although the gross weight of both trains was the same; hence it then became necessary to equate the tonnage of cars due to the gross weight of each.

About this time D. F. Crawford, general superintendent of motive power of the Pennsylvania Lines, devised his plan to make an arbitrary car allowance to meet the variation in gross weight of cars. This plan is to test engines with a train made up of all light empty cars and another test of the heaviest loaded cars; then divide the difference in the gross tons hauled by the difference in the number of cars hauled, then allow the result as an arbitrary to each car in addition to its actual weight.

In 1900 we made a test on the Ontario & Western with a full tonnage train of cars averaging 55 gross tons, and the engine had no trouble in hauling it over the grade, whereas with 70 gross ton cars it stalled. This required an investigation, and it was a conductor that solved the problem for us by showing that the heavy cars depressed the rails at the joints and made an increased up-hill pull, or, as he stated, it made waves in the track at the rail joints, due to light rail, poor ballast and surface. I cite this instance merely to show that the building of large capacity cars of itself would increase the expense of transportation, unless additional money was spent for the heavier rail and better roadbed, points which the public does not give proper consideration.

Mr. Cheeney, of the Chicago, Milwaukee & St. Paul, has devised the plan of loading engines on the basis of pounds of tractive power used, instead of gross tonnage, which is a very accurate basis. For example, on a .25 per cent grade if a 72-ton car requires eight lbs. per ton of tractive power, he figures it at $8 \times 72 = 576$ lbs., and would, in building up the train, use the 576 lbs. instead of 72 tons, and when the total pounds of tractive power used on all cars is equal to the tractive effort of the engine it has its full tonnage, or 100 per cent. The objection to this plan is the amount of time required in busy yards to compute the tonnage. This, however, can be overcome by reducing the pounds of tractive effort used per car to the ton unit and using a computing machine properly adjusted.

The most important feature in connection with the problem is to see that trains are properly loaded under any plan adopted. My experience leads me to believe that the work of the mechanical engineer, the traveling engineer and other officers in determining the resistance per ton of car and other factors previously stated, is the easy part of it. The difficulty is in having the terminal forces build up the trains properly with the assigned tonnage.

The ideal method to increase the train load is to equate the tonnage of cars, then arrange for the switching department to properly build up the train, and, when ready, have the yard clerk check the track, go to the office, pull the bills, foot the tonnage on the train resistance computer, notify the yard what tonnage to add to or take off, have the bills ready for the conductor when he calls, and avoid delaying the departure of the train,

which will save in overtime and fuel and often permit another train to pull in on the track cleared. After the departure of the train, the yard clerk should enter on his daily tonnage report the train number, number of cars hauled, the rating of engine and the equated tons hauled. A copy of this report should be sent to the superintendent or train master at the close of each day, in order that he may investigate at the time the cause of failure to properly load the individual train, instead of investigating the matter 30, 60 or even 90 days later, when the terminal is not in position to make an accurate explanation.

The 16-hour service law has materially affected the handling of tonnage, and frequently when trains are given their assigned tonnage not equated, and it happens to be largely in light capacity cars, it results in dragging over the road and very frequently in the train being tied up on the line on account of the 16-hour law, thereby creating considerable expense instead of resulting in a saving.

This condition can be largely overcome through the equated basis of loading engines, as under that plan the drawbar pull of all trains is equalized so that it is impracticable to have one train exert 40,000 lbs. of tractive power, as compared with another train with the same tonnage exerting only 32,000 or 34,000 lbs. By loading the trains with a uniform drawbar pull, the engines should be able to handle all trains within the time allowance.

Another factor which has been given considerable thought and on which a large number of tests have been made by some roads is the weather or temperature factor. Tests have been made of the resistance of different weights of cars at 30 deg. above and at different stages from that down to 20 deg. below zero, but personally I do not consider them as of much importance in practical operation for several reasons. The temperature may be 20 above zero with a drifting wind which is carrying snow into the cuts, making it much more difficult to operate than if the temperature was zero and calm. Again, the temperature at the initial terminal point may be 20 above and calm, whereas 50 miles out in the direction the train will move, it is snowing, drifting and down to zero. Again, at certain terminal points where they are fortunate enough to be located on an elevation where they get the benefit of down-grade or momentum in leaving the terminal, an engine can haul 300 or 400 tons more in cold weather than if the terminal was located in a sag where there was a slight grade leaving the terminal, for the reason that the lubricant congeals when trains stand a few hours in the yard waiting for movement, and creates considerable resistance on the journals in starting. Therefore, I feel that the question of loading engines in extreme cold and stormy weather is one which must be left largely to the discretion and good judgment of the men on the ground.

Another factor in connection with the rating of engines which should receive consideration is making some slight allowance for trains moving on busy track, where there are a large number of superior class trains, in order that the train may cross over on double track or take sidings and get out with despatch, instead of being obliged to frequently double out, thereby delaying the passenger trains. In other words, an engine with 40,000 lbs. tractive effort on a .25 per cent. grade on one division may be able to handle regularly 3,000 gross tons, whereas on another division where they have heavy traffic, it would be economy to reduce this tonnage to possibly 2,800 tons on account of the number of trains to be met, so that the physical conditions on the individual division or train district must be considered in the rating of the power. An arbitrary set of figures will not apply successfully at all points.

After having the conductors and engineers thoroughly convince me in actual practice that four 15-ton cars used more tractive power and pulled much harder than one 60-ton car, although the gross weight in each instance was the same, and having gone into the matter carefully, I was convinced that the load-

ing of trains on the tonnage basis would not be a success until such time as a device could be perfected which would simplify the mathematical complications, and I devoted much of my time in perfecting an automatic computing machine that would reduce the gross weight of each car to the tractive effort weight. In other words, a machine that would add the resistance of the car in lieu of the weight of the car. For example: If a 20-ton car is equivalent to 27 tons as to resistance, the machine instead of adding 20 would add 27, and if a 70-ton car meant only 60 tons in resistance, the machine when adding a 70-ton car would add 60 or 61 tons. With such a machine, a train of 80 or 90 cars can be computed and the drawbar pull determined by an ordinary yard clerk in less than 4 minutes.

In my judgment more money is lost in overloading the power than in underloading it, and the only safe and economical method for obtaining 100 per cent. efficiency is in using the equated basis.

INTERESTING ENGINEMEN IN THE ECONOMICAL USE OF FUEL AND LUBRICANTS

We are told that fuel used for locomotives in the United States alone, in 1911, amounted to about 132,000,000 tons, at a cost of approximately \$240,000,000. At least 10 per cent. of this did not come under the control of the engineers and firemen although, as a rule, it is charged to their performance, and it is not uncommon for enginemen to feel that a great deal of the fuel charged to them is used or wasted in other ways. If in any way fuel wasted before reaching the engine tank can be saved (although it costs nearly as much to save it as it is worth), it should be done, if for no other purpose than to show the enginemen that every reasonable effort is being made to give them credit for what they are able to do. No more fuel should be used in making engines ready for a trip than is necessary, and if extra fuel is used, by reason of lack of terminal facilities or engines ordered before they are needed, it should be charged to terminal consumption.

We wish to emphasize the necessity of a correct disbursement of fuel to each engine and the importance of the engineer familiarizing himself with the amount of fuel used during the trip. We have found it a good plan, where the chutes are equipped with scales or means for accurately measuring the coal, to occasionally meet the engines on their arrival at the coaling station and after the engineer has given his ticket for the amount he thinks necessary to fill the tank, advise him of the exact amount of coal delivered. By doing this the enginemen will very soon become familiar with what a given space in the tank will hold. Under present-day practices enginemen are not apt to be as familiar with this feature as in former times, when coal was delivered from pocket chutes or from buckets or buggies.

One railway has adopted the plan of posting bulletins at the terminals showing the tons of coal unloaded during the month, as per billed weights at the various coaling stations, and the percentage of this amount as represented by the engineer's estimate on their fuel tickets, also the fuel foreman's estimate. The result of this is that the engineers' estimates are now getting very close to the actual amount of coal received, whereas, formerly, they did not represent more than 60 per cent. of that amount.

The traveling engineer should be familiar with the various grades of coal. If it can be done, it is a good plan to visit the mines with the fuel agent or other purchasing officer. It is also a good plan to check weigh coal occasionally for their own information, to know how it compares with the billed weights. The traveling engineer should also use his efforts to have the coal properly prepared before being placed on the tender.

One of the best ways to interest the enginemen in what can be accomplished in the use of fuel and secure their co-operation is to make test trips in various classes of service similar to

those shown below, which are records of actual trips made. The scoops of coal are counted with a tally counter, unless the coal can be accurately measured otherwise. In making such tests, frequently the water used is noted, the distance run between water tank stops and the amount of lubricants used, or any other data that may be considered advisable.

FUEL PERFORMANCE.

Through freight, engine 1283, Springfield to Newburg, distance 119 miles.
 Gross ton miles handled.....130,401
 Total time on road.....7 hr. 40 min.
 Delay2 hr. 30 min.
 Coal used7 tons
 Coal per 1,000 ton miles.....108 lbs.

No coal taken at Sleeper. Water taken only one place on division.
 Per cent. rating, 101.

Through passenger, engine 1111, train 106, Fort Scott to Kansas City.
 Total running time2 hr. 45 min.
 Total delay8 min.
 Number of stops.....4
 Cars in train.....8
 Total car miles.....800
 Fuel oil consumed.....708 gal.
 Gallons per car mile.....885

The injector never worked at more than 50 per cent. maximum capacity.

Through passenger, engine 1051, train No. 4, Springfield to Newburg.

Total running time3 hr. 13 min.
 Total delay10 min.
 Total car miles.....840
 Amount of water used.....8,000 gal.
 Scoops of coal used.....401
 Average weight per scoop.....16 lbs.
 Amount of coal consumed.....6,416 lbs.
 Pounds per car mile.....7.63 lbs.

Engine held at Newburg from 5:20 p. m. to 2:00 a. m., and made ready on 46 shovels of coal. 53 square feet grate area.

Considerable publicity is given these records. They are frequently shown on the enginemen's bulletin book or copies are sent to the employees' magazine. Where the performance is especially good, the superintendent of the division or other officer commends the enginemen, a copy of the letter and performance being attached to their personal record files. We should give the men all the credit that is due them. They have to take the blame whether they like it or not whenever the performance is not good.

Another method in use on certain divisions is to send out a mimeograph form at the end of the month to each engineer, showing car miles or gross ton miles handled by him during the month, the total amount of fuel used and pounds of coal or gallons of fuel oil per car mile, per thousand gross ton miles and the average of all engines in similar service, with such comment as the traveling engineer may see fit to make.

In submitting this question to a number of engineers and firemen, their reply almost invariably is: "Give us regular engines; do the work on them, and let us know what we are doing in the use of fuel and lubricants." These items are not under the control of the traveling engineer, but are mentioned to show the arguments he has to combat. On many roads, certain conditions will not permit of assigning regular engines, and it is no doubt possible to maintain engines in pooled service in as good condition as in regular service, but it is rarely ever done, and it is therefore difficult to excite the same interest in both cases.

Without doubt the condition of the engine has more bearing than any other one item, and the traveling engineer should use his best efforts to have the engines maintained in the best possible condition. They should be made to steam with as large exhaust nozzles as consistent, it being understood that all other draft arrangements are properly adjusted before contracting the nozzle, but by all means they should steam freely. It is almost impossible to get a fireman interested in fuel economy on an engine that does not steam well. A periodical inspection should be made of draft appliances and a correct record of all measurements and sizes of nozzles maintained, in order that en-

gines of the same class will have uniform exhaust openings, which will permit the fireman to carry the same depth of fire in each engine of the same class.

Cab arrangements should be made convenient and comfortable; injectors of proper size and so maintained that they can be skillfully operated; valves not only square but well balanced, so that the engine can be worked in a short cut-off when necessary and still lubricate properly a throttle that will remain in any desired position; proper distance between the fire-door and the coal gate; fire-doors at a proper height from the deck; deck guards if necessary, so that the fireman will not have to be continually raking coal in to prevent it wasting from the gangway. Grates, flues, steam pipes and all draft appliances should be kept in first-class condition and the ash-pan provided with ample openings for air admission.

An electric flash light torch is a valuable aid to the traveling engineer, if he wishes to make an occasional personal inspection of draft appliances without opening the front end door, or for noting the condition of flues and grates. This is especially useful where fire-tube superheaters are in use, due to the fact that the ordinary torch test is insufficient, as the return bends are some distance from the flue-sheet and cannot be seen with the illumination furnished from an oil torch and also from the fact that they may be almost entirely clogged and still have sufficient draft to draw in the flame.

Engineers' work reports should be closely followed up, for if certain men are careless in making their reports, others will become discouraged, feeling that their efforts in properly locating and reporting defects are not appreciated, and while all engineers realize the importance of it, some of them are apt to become a little careless in reporting worn cylinder packing, leaky steam chests, worn choke plugs, pockets in the oil pipes, or valve motion in such condition that it will cause the valves to be worked in an 8 to 10-in. cut-off when a 5 to 6-in. cut-off will do the work.

Many men do not realize that they are using a little more fuel and supplies that are necessary, not because they are indifferent, but because their attention has not been called to the fact that it is possible to do better. In riding with the engine crews the traveling engineer should encourage the efforts of the engineer and fireman in handling the train with as little fuel as possible consistent with maintenance of the schedule. In doing this, if circumstances will permit, explanation can be made to the enginemen as to what a relatively small saving by each crew per trip will mean in decreased operating expense on the entire division for one month. Encourage them to make similar tests when you are not with them. A very good illustration is to have them experiment to see just what kind of a run can be made by working the injector at minimum capacity, or nearly so. Show them how to figure ton miles and car miles and ask them to come to you if the work reported on the engines is not promptly done or to advise you in regard to other items that need attention, in order to save fuel, and show them you appreciate it by having such matters looked after. Ask the engineer to handle the engine so as to assist the fireman in every way in keeping a clean fire. Nothing will cause the fireman to lose heart more than to have a fire spoiled by an engine slipping leaving a terminal, after he has been very careful in getting it properly prepared.

The most successful engineer will tell you that he attributes much of his success to knowing the condition of the fire at all times, as well as the physical condition of the fireman and in having the fireman confident in his ability to keep the engine hot, encouraging him to make a study of keeping a clean fire at all times, rather than in trying to keep the engine at the popping point every minute, regardless of what may happen to the fire in so doing and causing the engine to steam hard on the last part of the road with resultant waste of fuel.

Close attention should be given to see that the engines leave

the terminal with clean fires. The education of fire builders and engine watchmen is as necessary as that of the new firemen.

It is a good plan to keep a record of the condition of fires as they come into the terminals and the time required for cleaning them. Firemen who succeed in bringing in a good fire for a certain period—say 30 days—can be commended, while the firemen that do not bring in good fires should have their attention called to it and be asked for an explanation.

In the selection of men who are to become firemen, the traveling engineer should play an important part. He should see that the right material is selected. The men should make student trips not only with the best firemen, but with men who are known to be of a good disposition; have a talk with the student, if possible, before he goes to work and let him have an idea of the amount of fuel he will be required to handle and the importance of economy in its use to avoid extra labor to himself and needless expense to his employer. Encourage his confidence and help him to select proper reading matter on combustion and the locomotive.

Progressive examinations are in use on a number of roads, and this, in the opinion of the committee, is one of the very best means of interesting the firemen. This should, we believe, be rigidly followed up on every road.

General meetings for enginemen and all other employees whose duties may in any way affect the use of fuel are productive of good results. The attendance of the officers has a helpful influence. The meetings should be arranged for in advance and subjects announced and the men asked to give their opinions. Many suggestions will be offered, and, if they are practical, they should be tried out.

On one road, mechanical clubs have recently been formed; officers are elected and committees appointed from among the engineers and firemen, the traveling engineer usually being the president or a member of one of the committees. Subjects are arranged for in advance, a question box is provided and questions or suggestions are deposited therein and thrashed out at the meetings. Charts and blue-prints are provided, showing proper and improper methods of firing, drafting; also on lubrication and other matters of interest.

In the use of lubricants, a first-class terminal organization is necessary for the systematic care of the cellars. We believe each engineer should be furnished with his own hand oilers and supply cans, so that he will be credited with his savings. The oil should be charged to engineers and not engines, and the schedule should be sufficiently liberal to prevent issuing extra oil as much as possible.

On the road mentioned, where the traveling engineers are supervising the fuel performance sheets, soon after the records were started a number of enginemen advanced the idea that a more liberal supply of lubricants would save fuel, and an experiment was tried on one division. Although the schedule was considered quite liberal at that time, each engineer was given an extra supply of cylinder oil to start with and all concerned were advised that it was not the intention to save lubricants at the expense of fuel. The fuel and oil performances were both closely checked for a month, at the end of which time it was decided that there would be nothing gained by a change in the oil schedule previously in effect.

We believe it is practical in some cases to ask engineers to make tests of the amount of oil required in the various classes of service and to have the cylinder heads or valve covers removed for their information at the end of the trips or test.

While it is possible to run pooled engines with the same amount of oil as regular engines, generally speaking we believe engines with regular crews will be better lubricated than pooled engines on the same amount of oil. With regular engines, the engineer knows just how the cups are feeding and how all bearings are running. In pooled service, he will not know this or whether the lubricator was entirely fed out when the engine

came in, and the valves and cylinders dry. On this account he will probably feed the lubricator a little too fast to start with than on a regular engine. Also, not knowing how the engine will steam or do its work, he is more apt to fill the boiler a little too full when starting out than with a regular engine. Unless he drains the lubricator, he will not get the oil saved on easy trips. Pooled engines usually do not get over the road as well as regular engines. Again, if the oil goes out of sight in the gage glass, the engineer will probably adjust the feed to run to the end of the trip, regardless of the effect on the fuel consumption.

No test figures are at hand to show the effect of insufficient lubrication. The statement has been made before this association that not less than 12 to 15 per cent. in tractive effort is lost when lubrication is insufficient.

We believe it is a good plan to let the men know about what the fuel and lubricants cost and what the company, with their help, is trying to accomplish. What will awaken interest will maintain it, and this can only be accomplished by continually keeping after it. New ideas will continually present themselves and the enginemen will contribute many good suggestions.

Committee:—Robert Collett, chairman; J. F. Meredith, D. L. Eubank, L. Redford, W. H. Donohue, J. S. Lemley and C. F. Schraag.

DISCUSSION.

While the systems used for checking the fuel and oil consumption on a number of railways were clearly explained, there appeared to be little that is new or particularly successful in the records themselves. A number of speakers reviewed the possible points at which savings could be made, but it appeared that personal efforts, arguments and demonstrations were the most successful methods for accomplishing results.

The importance of full and active co-operation of the enginemen was mentioned by D. J. Madden (Erie). He had found that by assisting the enginemen in getting the locomotives in first-class condition and stopping steam leaks, particularly in the cab, etc., they would be more receptive of suggestions for saving fuel. The same feature applies in connection with an active defense of the engineman whenever he is right in an argument with the train master or other officer. If the enginemen are satisfied with their surroundings and know that the traveling engineer is their champion, his instructions in fuel economy will be much more faithfully carried out.

Several speakers advocated the concentration of effort on coal saving rather than on oil. One member stated that the same attention which would result in the saving of one cent's worth of oil would save two dollars' worth of coal.

A. G. Kinyon pointed out the desirability of more careful training of the fireman before he is put to work, and the advisability of greater supervision of his work at the start. He compared the methods of training machinists' apprentices and firemen. He also made a plea for greater supervision of enginemen as well, and stated that a traveling engineer should not have over thirty crews under his charge.

F. C. Wayer (Southern) said he had found a device for automatically registering the amount of time the safety valves are open to be of decided value in saving the considerable loss of coal through this channel. When the device was first applied it was found that the pops were open 300 minutes on each trip. This had now been reduced to an average of 30 minutes. The careful attention to features of this kind, together with demonstrations and instructions, had resulted in a saving of 6 per cent. of the fuel on his road last year. Among other things a careful watch of the fires brought to the ash pit had been most helpful in checking the firemen's work.

In closing the paper, Robt. Collett (Frisco) stated that not infrequently it was necessary to educate the higher officer in fuel economy, as well as the firemen, in order to have the necessary full cooperation all along the line.

INSPECTION OF LOCOMOTIVES

The committee is of the opinion that no money expended by the railways will return a larger dividend than that paid the enginemen for the short time it requires to make a careful terminal inspection and report. It is further of the opinion that there should be no one more capable of making this inspection than the enginemen, and therefore advocates a careful and general inspection by the enginemen, and asks their full support in taking care of the expensive and heavy power we are now handling.

The engineman should make close observation of the operation of the engine while on the road, in order to determine defects that cannot be so well located while the engine is at rest. On arrival at the terminal he should begin at the front of the engine and inspect the condition of the parts as follows: Condition of the smoke-box front to see that the door is properly secured and that no loose nuts exist about the front end. The condition of the cellars and bolts as far as he can see, all parts of the valve gear, guide bolts, frames, springs and rigging, ash pan slides, tender trucks, condition of couplers and operating mechanism, condition of truck and driving wheel flanges, note temperature of bearings, examine rods for loose bushings and nuts, cross-heads, driver and tender brake shoes and rigging. The engineman should report whether or not the engine throws fire dangerously and any defects, such as valves out, cylinder packing or valve blowing, engine steaming badly, injectors not working, pop valves out of order, flues or any part of the firebox leaking, grates out of order, any defect in the air brake equipment, rods or boxes pounding, and such other defects as would usually come under his observation while operating the engine. If there should be any pounds or blows that he has been unable to locate while on the road, a careful terminal test should be made.

Enginemen should be conversant with the safety appliance and federal inspection laws, and report any defects that would constitute a violation. Such reports as "engine pounding" or "blowing" or "steaming badly," should be discouraged. Careful checking of the work reports and the assistance of the roundhouse foremen will greatly assist in the education of new men.

We should bear in mind the importance of having men in charge of engines who are well posted on their construction and competent to handle them in the best possible manner. And in order to encourage them to reach this point of efficiency, we should be as exacting as circumstances will permit in requiring the men to be well qualified before promoting them, and after they are promoted require them to give intelligent and careful attention to the engines in their charge and hold them responsible for failure to report any defects they have had an opportunity to find by using reasonable care.

Committee:—H. F. Henson, chairman; G. C. Jones, J. C. Petty, W. H. Dellert, J. B. Hurley, R. H. Fish, M. J. Keating and G. S. Tillman.

DISCUSSION.

It seemed to be the consensus of opinion that the engineer should make as complete work reports as possible, and in any case they should cover all features that would not be evident when the locomotive was standing. These would include blows, knocks, pounds, stuck wedges, valves out, hot bearings, etc. Some roads require enginemen to report everything without going under the locomotive. In other cases, on some passenger runs, the engineman is not even given an opportunity to make an outside inspection at the terminal.

The difference between the work reports by enginemen on regular and pooled engines was alluded to and started a discussion on this much debated subject. It was clearly shown, however, that the pooled locomotives were an absolute necessity in many cases, and if the engineman will do his duty as he should he will report as carefully on a pooled locomotive as on one regularly assigned to him.

The fact that the work reported by enginemen is frequently not performed was given as one cause for the incomplete reports.

One railway has introduced a system of records showing the work not reported by the enginemen, which was discovered by the inspectors. A copy of this goes to the master mechanic, the superintendent and the enginemen each week.

ADDRESS BY H. T. BENTLEY

The splendid work that has been accomplished by this association has been noted not only by the mechanical officers, but by the operating officers of the country. I believe I am safe in saying that there is no association in the United States that is so sincere, so energetic and so progressive as the Traveling Engineers' Association.

The road foreman of engines has a hard row to hoe. You start a man out and say, "Get results." It is a pretty hard job, and often takes two or three years before the man really knows what he is going to do and how he is going to do it. My idea is that as soon as a road foreman is appointed, if there is a convention of this kind in session, the best thing we can do for him and the company is to insist that he attend it and mix with the old timers—men who have been through the mill, men who know what to do and how to do it. It is a whole lot better to be able to get information from some fellow that knows something about it than to go digging around for three or four months and not get anywhere.

A new road foreman of engines is very apt to get discouraged. There is no question but that it is discouraging when a man works and does not get anywhere; but a little encouragement, a pat on the back from the man in charge, makes the man feel a whole lot better. A little encouragement is one of the finest things to bring about good results.

One of the worst things that the railways have to contend with at the present time, is the rough handling of trains, particularly passenger trains. I believe that there is a great opportunity, with very little effort on your part, to so improve the passenger service of this country that it will be the talk of the country and the talk of the traveling public.

There is another thing that will improve the service, and that is for you to preach and practice the safety habit. You have heard of the safety committees being appointed on all the prominent roads and some of the smaller ones; the results which they have obtained are remarkable. The fact that accidents have occurred in our shops which could have been prevented by these safety committees seems plain. We are all prone to take chances, and you ought to do all you possibly can to stop any chance taking by your men. The papers are altogether too glad to tell of two or three hurt here, and two or three killed there, simply because a man was taking a chance. If you want to improve the service of the American railways, preach and practice the safety habit. It will pay everybody concerned, and particularly the company for whom you are working, in the satisfaction that comes from the reduced loss of life and injuries.

There is another way in which the service can be improved, and that is in the emission of smoke. The engineer and the firemen are jointly responsible for excessive emission of smoke. The fireman, of course, is handling the coal, and he can do more as to the emission of smoke probably than the engineer, but the engineer by co-operation can reduce it so that it is not a nuisance.

The superheater engine has been in service long enough for us to know what it will do and how it will do it, and about how it compares with the saturated steam engine. The success of the superheater engines has been made by the efforts of the traveling engineers and the men who are operating them. When the engines first came out we had a number on the Chicago & North Western, and had so much trouble with them that we felt we had a white elephant on our hands; but by putting it up to the traveling engineers and the men who were operating the engines, as well as to the roundhouse to do their share, we found that the superheater engine was practically as easy to maintain

as the saturated steam engine, and very much better results could be obtained by improved train service, decrease in the cost of fuel and other things that you know all about. I want to thank the traveling engineers and the men under them who responded to their instructions, for the success of the super-heater engine.

Where you are getting records you ought to try to have them just as accurate as you can—coal, oil or anything else that pertains to your work—because an inaccurate record is a laughing stock to the men you are talking to. I have seen records which showed that a number of men had been operating certain engines with an average coal consumption of so much; and the officers have been inclined to pat the fellows on the back who were above the average and condemn the men who were below. We found that coal reports of that character were not right, because we had no way of knowing but that the lowest man was altogether too high. Working on that theory, we made some tests on the Galena division, and found that the engine crews were burning very much more coal than was really necessary to perform the service which was required of them on most of the runs; after a number of simple but careful tests we set a standard of coal consumption for certain trains which was very much below the average of our reports. Since then we have been endeavoring, not only on the one division but on all divisions, to bring the men up so that we can say that they are burning about the amount of coal that we think they are justified in burning, and no more.

The same thing applies to oil. There is no reason why on our oil reports we should not set a standard and say that that is the standard for that trip, and not make an oil report with averages and say any man above the average is all right. Speaking about oil, you will often see an engineer on a local train get down with his oil can and oil around nearly every time it stops—every fifteen or twenty miles. I was on a train the other day that ran 158 miles without a stop and wondered how he got over the road without oiling. If that man can run 158 miles without oiling, there is no reason why a man on a 60-mile run has to get down every few miles and oil.

One of your best friends is the roundhouse foreman. He can either make or mar your opportunities; that is, he can help you to good results that you can not get by yourself. The road foreman of engines and the roundhouse foreman should be very close together. Your interests are identical and you should co-operate fully.

The American Railway Master Mechanics' Association should co-operate with such an organization as this. The work that you gentlemen are doing is so great and so good and we think so much of it, that I believe that the Master Mechanics' Association should call on you as an association to do some of the things that they have not time to do, and I know you would carry the burden nobly and help them out. The same offer was made by the General Foremen's association at a meeting I attended last year, and they volunteered to take up any subject that the Master Mechanics' Association felt that they could not handle, and dig into it and present a report to the Master Mechanics' association showing what they had found. I believe that there is a possibility of the Master Mechanics' Association helping you out and your helping them out in some things that they are not able to handle themselves, and I just simply throw it out as a suggestion that possibly you might volunteer, if you think proper, to undertake some such action.

ADVANTAGES AND DISADVANTAGES OF LEAD

BY J. F. JENNINGS.

It is impossible to give a fixed rule for the amount of lead to be given an engine, as what would be suitable for one type would not do at all for another because of the difference in clearance, cylinders, volume, cut-off, etc. The only practical way to determine the best lead is by the use of the indicator,

which will show whether or not the engine has the proper valve setting.

ADVANTAGES OF LEAD.

It gives pre-admission of steam, or steam is admitted into the cylinder before the piston has reached the end of the stroke, thus furnishing a cushion for the piston and reciprocating parts.

It gives a wider opening of the steam ports when steam is admitted, insuring as nearly as possible full boiler pressure at the beginning of the stroke and also gives an increased port opening after the crank pin has passed the center, by keeping the port open longer.

Lead permits of an earlier cut-off in the stroke, and consequently a longer expansion of the steam. An increase of one-eighth of an inch in lead would reduce the cut-off a total of one inch on one side of the locomotive; but it must be remembered that an increase of lead hastens every other operation of the valve.

During the exhaust the walls of the cylinder and the piston have had a chance to cool to a certain extent and the pre-admission of steam or lead insures the reheating of these parts at an earlier moment than would be the case without lead.

DISADVANTAGES OF LEAD.

When the crank pin is at or near the dead center, any pressure against the piston will have no effect in turning the wheel, and if the engine has lead it will actually tend to work against the cylinder on the other side of the locomotive, which is at its mid-stroke; especially is this true for locomotives used in slow service with hard pulls. This may be overcome to a certain degree by setting the valve blind in back gear in order to help the forward gear. By doing this, the lead is made almost constant for full and mid-gear.

We all know that when running at full speed, if we shut off the throttle and drift, we notice no ill effects from pounding; in fact, the engine sometimes runs better, due to the lack of pounding which occurred when it was working steam. This would seem to indicate that at high speeds the cushion of steam provided by lead is not at all necessary to arrest the motion of the reciprocating parts.

On locomotives with Walschaert valve gear the lead is constant for all cut-offs. This is a disadvantage for the following reason: The clearance volume to be filled with steam before the beginning of each stroke is the same and the amount of time for filling this space decreases as the speed increases. This shows that the amount of lead which would do for a slow speed would not give the best results for a high speed; therefore a constant lead is not desirable.

Again, suppose an engine with Walschaert gear and constant lead to be working with the lever in the corner and the piston nearing the end of the stroke; in this position the piston is traveling slowly while the valve is traveling fast. Due to the lead given the valve, the piston has an inch and a half or 2 in. yet to go when a large amount of steam is admitted into the cylinder. All lost motion of the worn parts will be taken up suddenly and a pound will result. It would seem from this that a negative lead would be an advantage because steam would not be admitted to the cylinder until the piston was in a position to use it to good advantage in the actual work of turning the wheels.

With the modern engine equipped with piston valves the exhaust lap is undoubtedly a move in the direction of economy. You can thereby cushion the reciprocating parts and fill the cylinder clearance by compression and to a certain extent maintain cylinder temperature by compression. Then when the crank has passed the center, let admission take place, or, as one writer said, "What we want is prompt admission, not pre-admission."

These few reasons for and against lead, would appear to indicate that there is not so much loss or not so much gain by

having early or late admission of steam and that the lead or absence of lead necessary for a locomotive should be determined which will give the best results, this of course varying with different types of locomotives, with the service in which they are used, and with the physical characteristics of the road.

DISCUSSION.

W. E. Symons opened the discussion on this subject by warning the members against attempting to decide on the correct amount of lead regardless of the local conditions. Each class of locomotive and each class of service may require radically different treatment in this respect. He illustrated his meaning by an instance in his experience where an increase in the lead of some passenger locomotives, which experience with other locomotives on the division seemed to indicate was the proper move to improve their operation, proved to be radically wrong, and it was only when they were given a negative lead that they could be operated satisfactorily. This was due to the fact that the locomotives had a very short main rod, short link radius and a rocker with the longer arm on top. In reply to a question, Mr. Symons explained that, as a general proposition, a reduction of steam pressure would not require an increase in the lead if the locomotive remained in the same service.

R. F. Darby, mechanical engineer of the Pilliod Company, drew attention to the necessity of considering the difference between variable and constant lead valve gears in deciding the proper lead to use. With the former the difficulty is generally to avoid too much lead at the shorter cut-off, while with the latter care must be taken not to get too small a port opening with a short cut-off, which means that the proper liberal lead must be maintained. On the request of a member, Mr. Darby explained the difference between lead and pre-admission as follows: Lead is the amount of valve opening when the engine is on dead center. Pre-admission is the distance of the piston from the end of the stroke when the valve starts to open.

Mr. Darby was requested to explain the Baker valve gear, and confined his remarks to possible break-downs and the proper procedure in each case. It seems that with this type of gear any break between the return crank and the bell crank would not put that side of the locomotive entirely out of commission since the valve movement that could be obtained from the combination lever would still be available and would give a port opening equal to the amount of lead. Any break, however, between the valve or cross-head and the bell crank would require the blocking of the valve.

In closing the discussion, Mr. Jennings stated that in his opinion, the only way to determine whether the full or part throttle opening is better is by the use of an indicator.

OTHER BUSINESS

Report on Master Mechanics' Association.—F. C. Thayer, the delegate of the association to the 1912 convention of the American Railway Master Mechanics' Association, read a report in which he briefly outlined the reports and papers presented, the trend of the discussions and the actions taken.

Reports of Secretary and Treasurer.—The secretary's report briefly reviewed the history of the association which has grown from 14 members in 1892 and 53 in 1893 to 882 at the opening of this convention. During the twenty years there have been 153 subjects acted on and in over 90 per cent. of the cases the recommendations were adopted. The treasurer's report showed a balance of \$2,884.66.

Subjects for 1913.—The committee on subjects recommended three committee reports and three individual papers to be considered at the next convention. The committee reports were: Uniform instructions to engineers on the handling of superheater locomotives. Credit due the operating department for power utilization and train movement that reduces the consumption of fuel per ton mile. The care of locomotive brake equipment on the road and at terminals; also methods of locating and report-

ing defects. The individual papers were: Advantages obtained with the brick arch in locomotive service. What can we do to eliminate the black smoke evil on locomotives burning bituminous coal? Scientific tonnage rating.

Election of Officers.—The following officers and members of the executive committee were elected: President, W. H. Corbett, Michigan Central, Jackson, Mich.; first vice-president, F. P. Roesch, El Paso & Southwestern, Douglas, Ariz.; second vice-president, Robert Collett, Frisco, St. Louis, Mo.; third vice-president, J. C. Petty, Nashville, Chattanooga & St. Louis, Nashville, Tenn.; treasurer, C. B. Conger, Wm. Sellers & Co.; secretary, W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y. Executive committee: W. C. Hayes, Erie; H. F. Hensen, Norfolk & Western; Martin Whalen, Cleveland, Cincinnati, Chicago & St. Louis; J. W. Hardy, Rock Island; F. C. Thayer, Southern; and V. C. Randolph, Erie.

Next Meeting.—In the ballot for the location of the 1913 convention, the three cities receiving the highest number of votes were as follows: Chicago, New York and St. Louis. The executive committee will select the place of meeting from these three. There appeared to be a very strong sentiment among the members in favor of again meeting in Chicago.

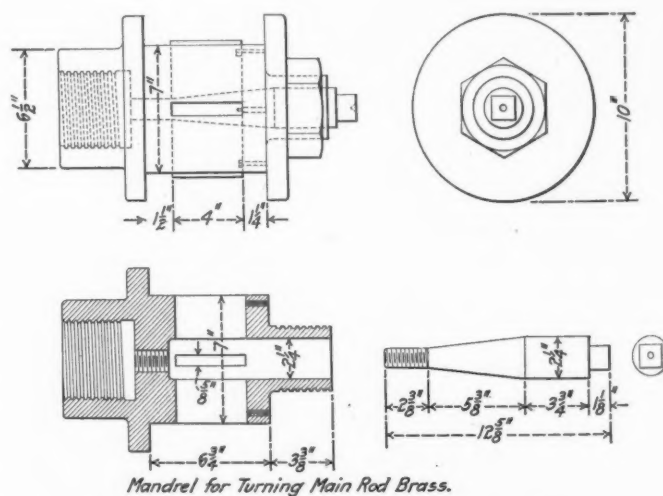
SOLID END MAIN ROD

BY C. D. ASHMORE,

General Foreman, Chicago & North Western, Clinton, Iowa.

A type of main rod that has no straps or bolts has been developed at the Clinton, Iowa, shops of the Chicago & North Western. This design, after eighteen months' service, has demonstrated its success and has proved decidedly economical in cost of repairs and renewals, as well as convenient and cheap in running repairs.

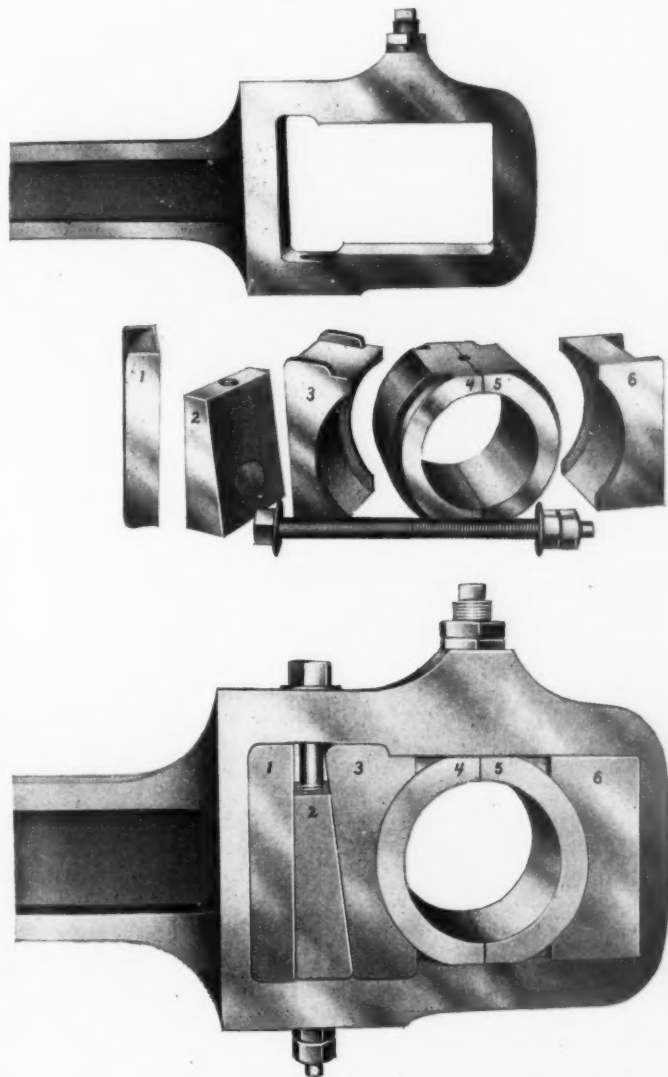
This style of rod is forged in the usual manner, and after being milled and having the ends planed to the proper thickness, the openings in both ends are laid out by templets and four



$1\frac{1}{2}$ in. holes are drilled in the corners. The rods are then taken to the slotter and the center pieces are cut out, and the openings are machined to fit the templet. Careful records have shown that the first cost of labor on the road itself is considerably less than on the strap, or open type of rod.

The parts that fit into the opening in the back end of the rod are all made to jigs and templets, and are interchangeable. There are six of these pieces, which are shown both separately and assembled, in the accompanying illustrations. Nos. 1, 2, 3 and 6 are cast steel, while 4 and 5 are brass. The shoe marked 1 has flanges $1\frac{1}{4}$ in. deep, which hold in place and retain any

shims that may be required. Wedge 2 has one face tapered to a angle of $1\frac{1}{2}$ in. in 12 in. This wedge is the same width as the shoe, and has a $2\frac{1}{2}$ in. hole drilled through it near the bottom. There is also a $1\frac{3}{32}$ in. hole drilled through the center from top to bottom. A brass plug is pressed in the large opening and is drilled and tapered for a $1\frac{1}{8}$ in. adjusting bolt. The cast steel and filler block 3 has $\frac{1}{2}$ in. flanges top and bottom and is milled or bored out on its inner face to leave a $\frac{1}{2}$ in. should-



Back End of Main Rod Showing Parts Dismantled and Assembled.

der on each side for retaining the brass. The two brasses are duplicates and are sweated together and turned on the outside by means of templets to fit between the flanges of the filler block. They are then faced off top and bottom to a sliding fit in the rod opening. The filler block 6 is the same as 3 on the inner face, but has no flanges on the top and bottom. It, however, includes $1\frac{1}{4}$ in. flanges on each side at the back, which hold it in place and retain the shims.

It will be noted that there is but one drilled hole in this construction, that being for the wedge adjusting bolt. As this is not subject to appreciable wear, it appears that the only parts needing renewal will be the brasses. These, being jig made, can be finished complete with the exception of the bore for the pin fit and retained in stock. It will be noted that even though the brass is loose top and bottom it will not work up and down in the rod opening on account of its round surface in contact with the retaining or filler blocks.

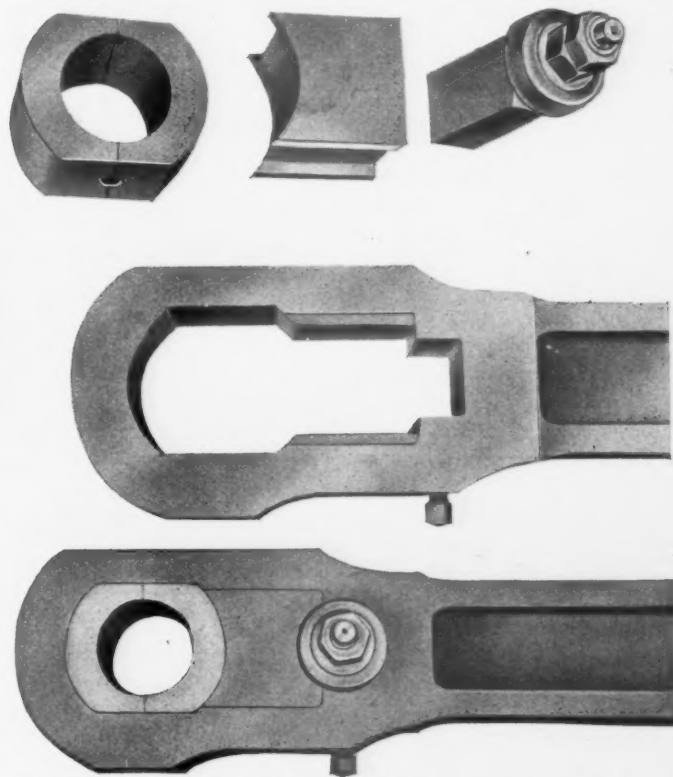
For repairs in the engine house, this back end can be dismantled in 10 minutes, the process consisting of removing the

wedge adjusting bolt and slipping the wedge out sidewise, which permits the removal of block 1 and the application of a liner. If it is necessary to renew the brasses, filler block 3 is slipped backward and the enlarged opening in the rod permits them to be removed. The brasses can then be slipped out sidewise, the same applying to the filler block 6 after the brasses have been removed.

At the front end of the rod the construction is even more simple, consisting of two round turned brasses, one filler block and a wedge, the construction and arrangement of which are clearly shown in the illustrations. It will be noted that a set screw is provided for holding the wedge in place. The brasses are not provided with shoulders, since there is no opportunity for their slipping out sidewise when in service. They, however, have the round bearing surface on either side which prevents any vertical movement.

Special jigs have been developed for manufacturing the various part of this rod at the Clinton shops. After the two filler blocks 3 and 6 have been finished on their outside surfaces, they are placed in a cast iron frame as shown in one of the illustrations. Four set screws with steel dogs hold them in place. The jig is then clamped to the table of the boring mill and the special boring tool, also shown in the illustration, is used, which finishes their interior circular surfaces and flanges to exact size. A limit gage assures the accuracy of this work.

For finishing the brasses, the process consists of shaping the two adjoining edges, sweating the halves together, facing them, and boring out for the pin fit, if they are to be applied



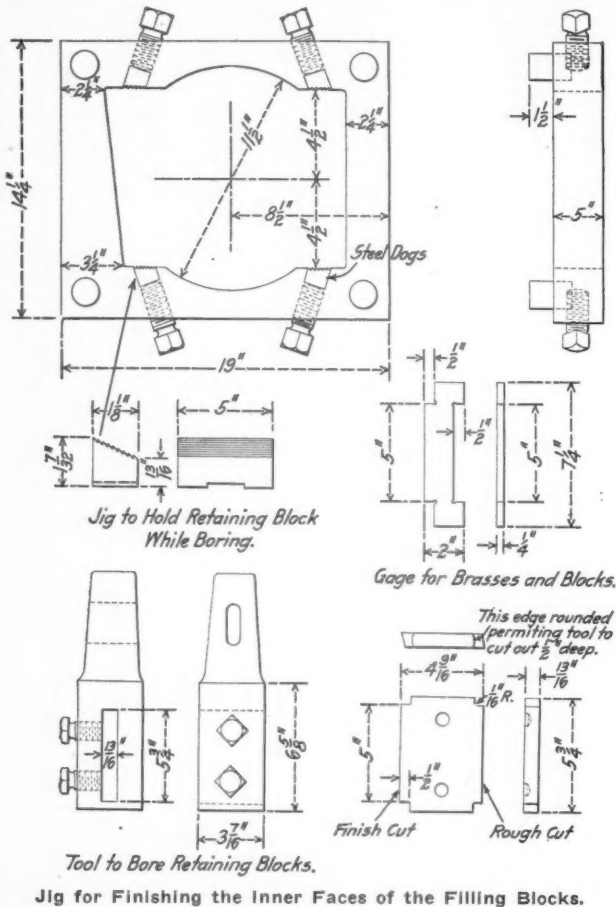
Front End of Main Rod Showing Parts Assembled and Separately.

immediately and the size can be obtained. They are placed on the mandrel, shown in one of the illustrations, which is attached to the lathe spindle, and are accurately centered by four adjustable jaws forced out by a tapered pin in the center. They are then clamped in place and turned on the outside, the same limit gage used for the filling blocks being employed to insure an accurate fit at the flanges. Standard calipers are also provided for giving the proper diameters.

Careful records have shown that the first cost of this rod complete is \$25 less than the strap, or open end rod. In re-

pairs, if the old brass is simply closed and rebored, it will cost but 79 cents for labor to put the rod in condition for service. If new brasses are required for both ends, the total cost for labor and material of this rod will be \$1.74, as compared with \$6.38 for the strap and bolt rod, the details of these costs being shown in the tables below.

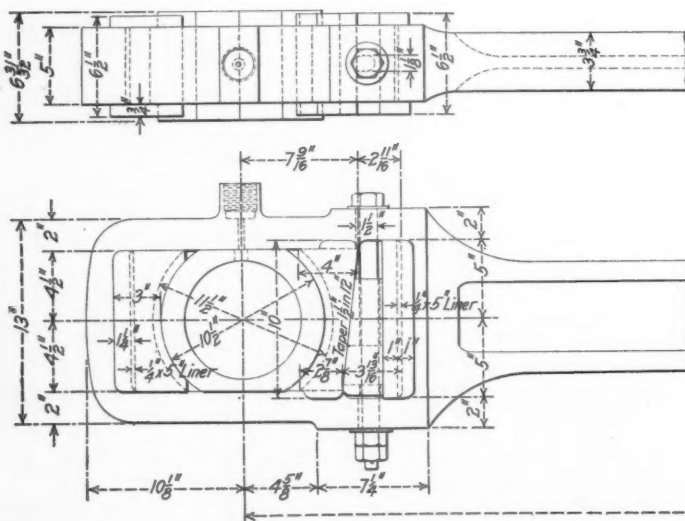
For the purpose of estimating the saving this type of rod



will give as compared with the strap end rod, both for repairs and renewals, the following data based on the costs at the Clinton shops are impressive:

Comparative cost of labor:

Solid End Rod.	
Dismantling rod (10 minutes).....	\$0.05
Closing brasses .....	.20



Solid End Main Developed at the Clinton Shops of the Chicago & North Western.

Fitting front end brass.....	.70	
Closing and reboring brass.....	.79	
Total	\$1.74	\$1.74
<i>Strap Rod.</i>		
Stripping back end.....	\$0.30	
Closing brasses, babbitt and replanning strap fit.....	1.35	
Hand fitting brasses to strap (half hour).....	.19	
Closing strap, refitting, reaming bolt holes, etc. (6 hrs.)..	2.37	
Fitting three new bolts (1 hr.).....	.20	
Cost three new bolts, 24 lbs. at 3c.....	.72	
Fitting front end brass (3 hrs.).....	1.25	
Total	\$6.38	6.38
Difference		\$4.64

Comparative cost of material:

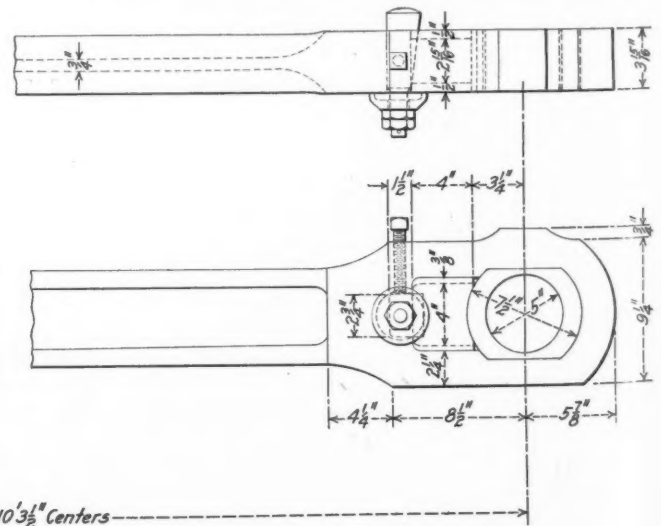
<i>Solid End Rod.</i>		
New brass, back end, 114 lbs.....	\$12.70	
Labor .....	.59	
New brass, front end, 37 lbs.....	4.12	
Labor .....	.39	
Total	\$17.80	\$17.80
<i>Strap Rod.</i>		
New brass, back end, 150 lbs.....	\$16.71	
Labor	1.56	
New brass, front end, 53 lbs.....	5.90	
Labor	1.37	
Total	\$25.54	25.54
Difference		\$7.74

Comparative roundhouse saving:

<i>Solid End Rod.</i>		
Refit back end brass to pin.....	\$0.90	
Refit front end brass to pin.....	.59	
Reline back end wedge.....	.10	
Total	\$1.59	\$1.59
<i>Strap Rod.</i>		
Refit back end brass to pin.....	\$1.42	
Refit front end brass to pin.....	.59	
Reline back end wedge.....	.40	
Total	\$2.41	2.41
Difference		\$0.82

The patents on this design of main rod are controlled by the Locomotive Improvement Company, Clinton, Ia.

ACCIDENTS ON THE UNION PACIFIC-SOUTHERN PACIFIC SYSTEM.
--Julius Kruttschnitt, director of maintenance and operation of the Union Pacific and the Southern Pacific, states that for four years not a passenger on the Southern Pacific lost his life through collision or derailment. During this period 157,000,000 passengers were carried an average distance of 42 miles. The Union Pacific in approximately the same period of time had but a single accident which resulted in the death of a passenger. These records are attributed to the automatic block signal system, on which \$5,000,000 has been spent during the past five years.

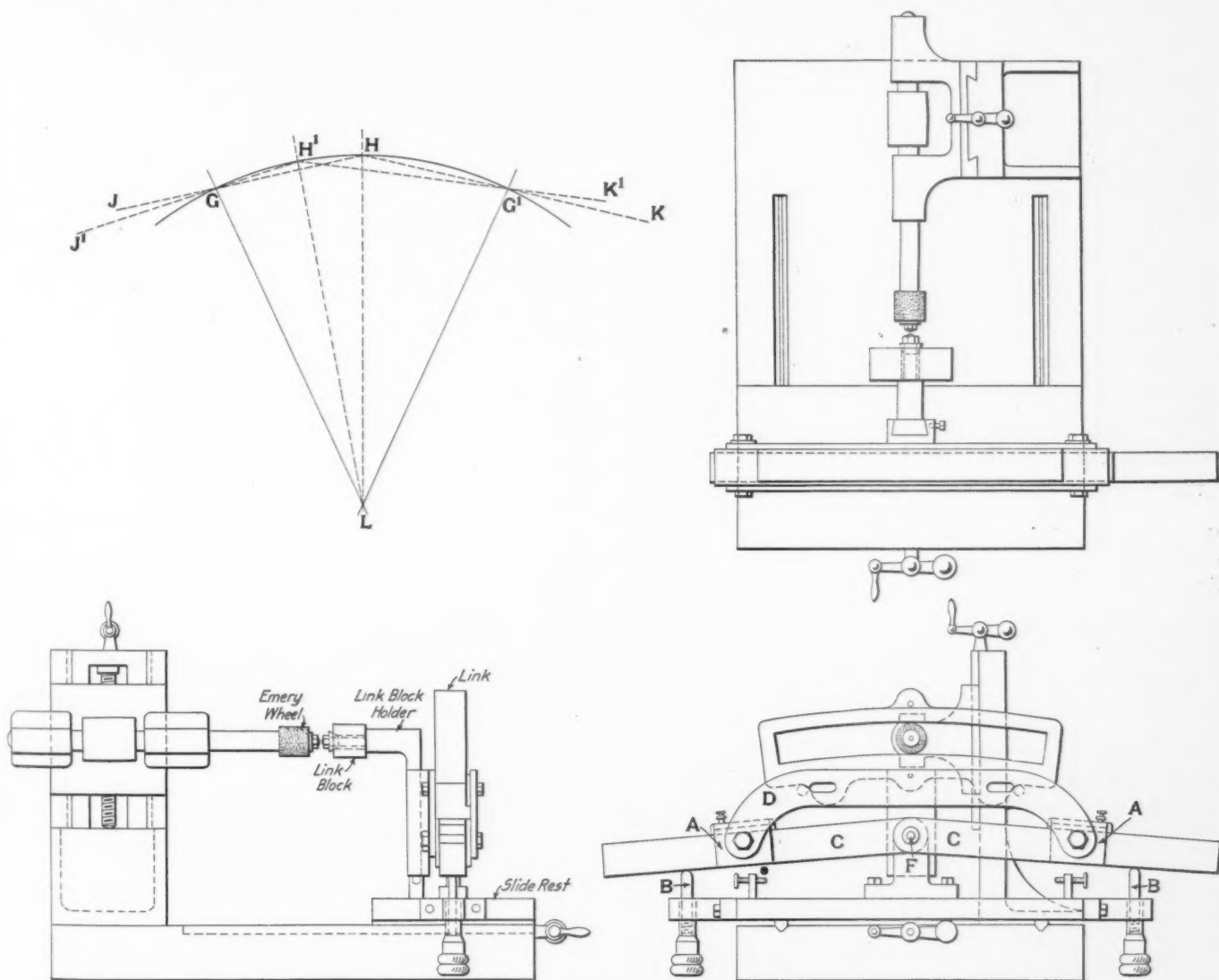


LINK GRINDING MACHINE

A number of years ago, F. H. Dersch, foreman of the Chicago & North Western repairs shops at Dubuque, Iowa, designed a simple link grinding machine, which has been used for ten or twelve years without repairs. It consists of two bars $C C$, which are pivoted at their ends and can be set at any angle with each other by adjusting the micrometer screws $B B$. Attached to these bars, $C C$, either by sliding blocks $A A$, or riding on them with rollers, there is a frame D to which the link to be ground is bolted. Set with its center in a vertical plane above the pivotal point F of the two bars is an emery wheel, which can be raised or lowered in a line with the center F . The method

and kept always against the pins $G G^1$, then the path of the point H , will be the arc of a circle. And that circle will be the one passing through $G H G^1$. If the straight edges be moved to the position $H^1 J$, $H^1 K^1$, the point H^1 will still be on the arc of the circle, because the angle at H is constant and the points $G G^1$, being fixed, measures a constant length of arc. It is also evident that if a straight edge were laid along the points L and H , and was held at L , the center of the arc $G^1 H G$, the point H on the straight edge being constrained to move along the arc $G^1 H G$, that every point on the straight edge would describe the arc of a circle.

The link grinding machine works upon the same principle; but, instead of moving the straight edges over the points $G G^1$, the



Link and Link Block Grinding Machine.

of operation is to set the bars at the proper angle to give the desired radius of curvature to the link; then bolt the link to the frame D and move the latter to and fro, raising or lowering the emery wheel so that it will be in contact with one face or the other of the link.

The principle on which the machine works is the old geometrical one that equal angles at the circumference of a circle are always subtended by equal arcs. A familiar application is to be found in the method of drawing a circle by means of two straight-edges held at a constant angle to each other, and moved across two pins. For example let $G G^1$ be two pins, and $H J$, $H K$ be the edges of two straight edges held together at H at a constant angle. If the two straight edges are moved to and fro

points $G G^1$ are moved over the straight edges. It is evident that if this is done the imaginary arc $G H G^1$, will always coincide with the path of H , and any other point, such as a point on the link that is bolted to the frame D will describe a circle concentric with the arc $G H G^1$. The link block is also ground on this machine, being fastened to the holder, as shown, which is connected to the frame D and has the same arc motion as the link. The adjustments possible with this machine are such that links of any radius from 38 to 130 in. may be ground on it.

TWENTY-FOUR O'CLOCK SYSTEM ON THE CONTINENT.—At present the time tables of the Belgian, Italian, Spanish and French railways show times from 1 to 24 o'clock.

SHOP SAFEGUARDS*

BY W. H. SNYDER,

General Foreman, New York, Susquehanna & Western, Stroudsburg, Pa.

There is no more important question than that of the safety of human beings. Railways especially are put to a great expense in bringing their equipment up to the requirements of the Interstate

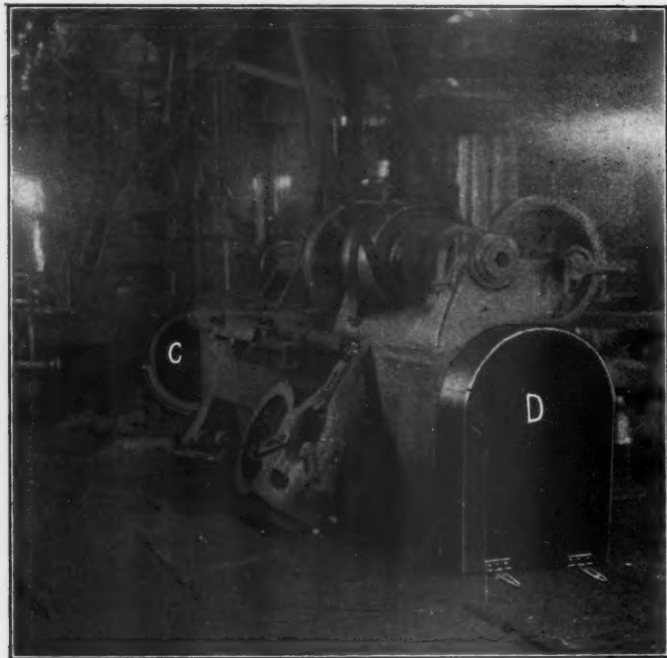


Fig. 1—Safeguards Covering the Gears on a Lathe and Planer.

Commerce Commission; the laws which compel them to apply a certain style handhold or step and to drill staybolts in a locomotive boiler to a certain depth and diameter are all done for safety.



Fig. 2—Safeguarding the Gears and Pulleys of a Power Roll.

All employees should be awakened to the importance of safety and protection, and should always be on the lookout for their safety, as well as for that of their fellow workmen.

*Entered in the Safety Competition, which closed June 1, 1912.

Many accidents are prevented by installing safety devices, and if this is combined with care a large number of accidents can be avoided. When men are first started to work on machines they should be fully instructed by the foremen on how to operate them safely and they should be cautioned from time to time. Each workman should be made to feel that he is a safety inspector

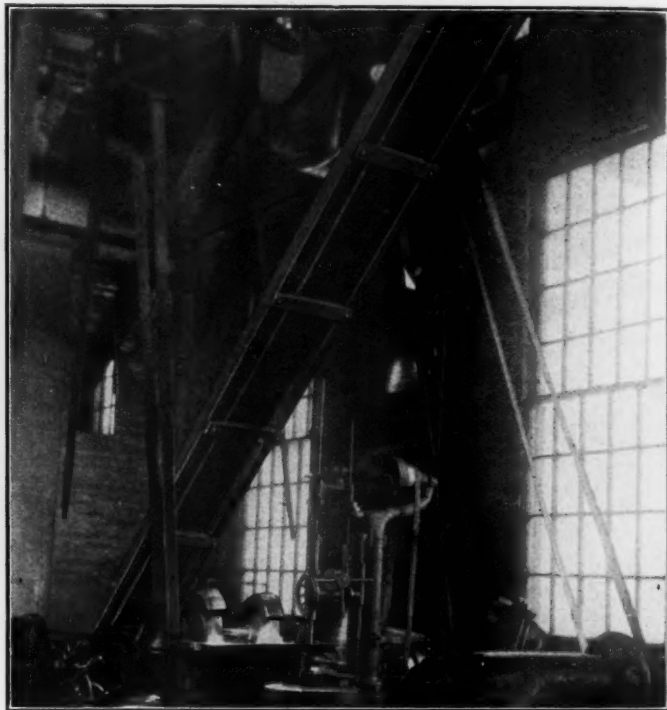


Fig. 3—Protecting the Workmen From the Breakage of a Main Belt.

and any suggestions from him should be cordially recognized. The state legislatures throughout the country are directing unusual attention to the prevention of accidents to operatives and

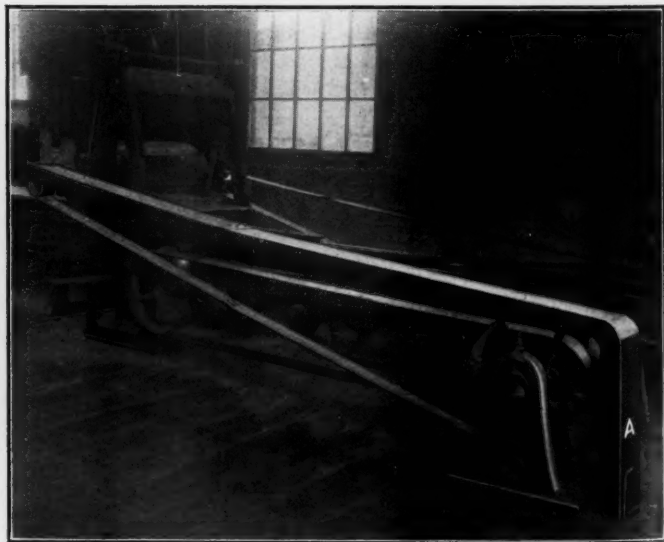


Fig. 4—A Neat Guard over a High Speed Belt on a Wood Planer.

manufacturers are anticipating them in safeguarding their employees.

Foremen are essential factors in this work and should be carefully selected for their ideas of caution and discipline and the desire to prevent accidents. Safety devices should be installed wherever possible; they will prevent many serious accidents and their use should be insisted upon wherever practical. Warning

signs will prevent many accidents. Oiling or cleaning machines around gears or any revolving parts should not be done while the machine is in motion. Workmen should wear tight-fitting clothing and under no consideration should they wear jackets outside of their overalls; the use of gloves should also be avoided around machinery that is in motion. These are some suggestions that if followed will greatly decrease the number of accidents. The safeguards must be maintained by periodical inspections to see that they are properly used for the purpose for which they were intended. These suggestions all come under the control of the foreman directly in charge and he must watch and educate those who show any tendency toward being reckless.

Two typical safeguards are shown in Fig. 1. *C* is a guard covering the large and small gears on a planer and *D* shows a well arranged guard covering the gears on a 24 in. lathe; the guard on the lathe is hinged at the bottom making it convenient to move when it becomes necessary to change gears. A safe-

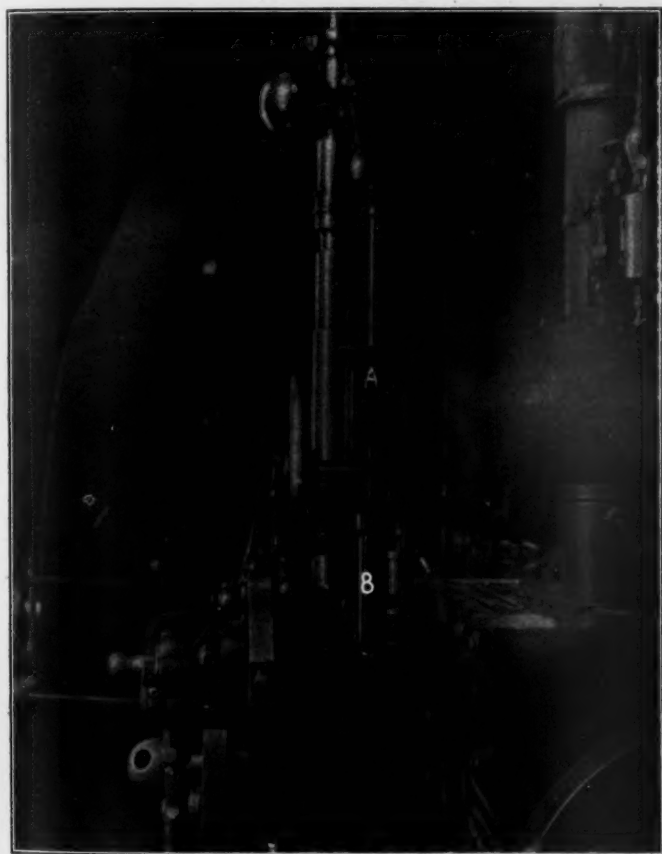


Fig. 5—A Simple Device, Controlled from Several Points in the Shop, for Stopping the Engine.

guard around the gears and pulleys of a power roll is shown in Fig. 2.

A good substantial guard under a main belt is shown in Fig. 3. This is so arranged that if the belt should break it cannot strike anyone. A neat guard over a high speed belt on a wood planer is shown in Figure 4. This is hinged at the lower end of *A* to allow it to be adjusted when raising and lowering the cutting head.

A simple and useful device for stopping the shop engine by compressed air is shown in Fig. 5. The rack *A* is of 1 in. square iron, 12 in. long, and has a piston on the end which fits into the cylinder *B* which is 2 in. inside diameter. The cylinder is secured on a bracket in such a way as to allow the air pipe to be connected at the bottom. The gear on the throttle stem is 4 in. in diameter and the throttle can be closed by admitting air to the cylinder *B*, the rack driving the gear on the throttle stem. A pet cock is used for releasing the air from the cylinder so that,

if desired, the engine can be started again in a few seconds. In each department of the shop is one or more air valves, as shown in Fig. 6. The pipe *A* is painted a bright red for a distance of about 18 in. and the handle *B* of the valve is painted white,



Fig. 6—One of the Air Valves in the Shop for Stopping the Engine in an Emergency.

giving a good contrast. Alongside of this valve is a notice in a small frame, which reads as follows:

NOTICE, EMERGENCY VALVE.

This valve to be used only in case of danger to life or machinery. If any one is caught in machinery or anything is wrong with machinery that will do damage the valve should be opened until the machinery stops.

By actual test it has been found that the valve only has to be opened about four seconds to close the throttle, which brings the engine to a standstill in 21 seconds. These emergency valves



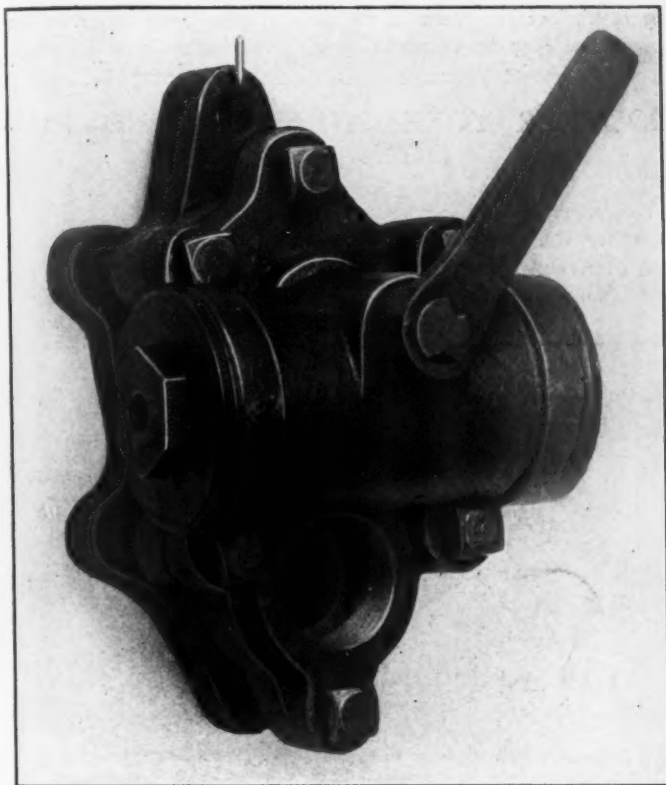
Fig. 7—Railing and Guards for Safeguarding Woodworking Machines.

are located in conspicuous places and every shopman knows their location. They are tested once a week.

A pipe railing around woodworking machines in the planing mill is shown in Fig. 7; a guard over a rip saw is also shown to the right at *A*. This is so arranged that it can be adjusted to

NEW LOCOMOTIVE BLOW-OFF VALVE

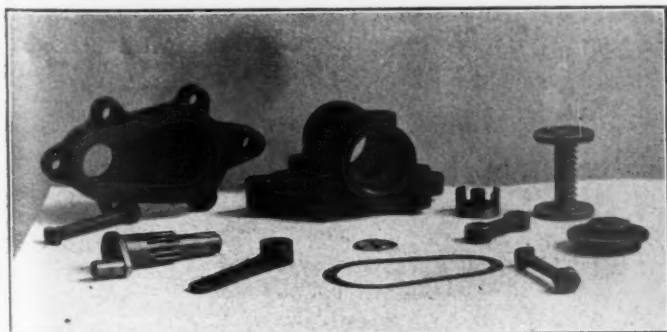
In some districts it is necessary to frequently open the blow-off valve while the locomotive is in operation on the road. In fact, in many sections a more frequent use of the blow-off valve would improve the operation of the locomotive and reduce the cost of boiler maintenance. It is, therefore, desirable to make the opening and closing of these valves as convenient to the



Osmer Locomotive Blow-Off Valve.

engineer as possible, and valves operated either by air or steam have been designed and successfully employed.

A blow-off valve of this type, designed and patented by J. S. Osmer, master mechanic, Chicago & North Western, Boone, Ia., is shown in the accompanying illustrations. It consists of two main parts, one of which is secured to the boiler by means of a



Parts of the Osmer Blow-Off Valve.

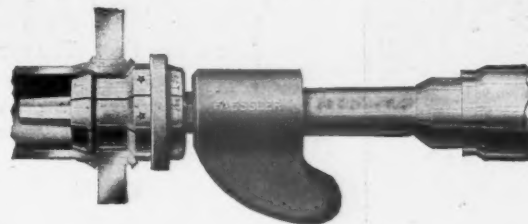
short pipe nipple and a stud. The other part, including the cylinder and all the operating mechanism, is secured to the first member by six bolts. There is a large opening in the outer casting which is placed opposite the opening in the boiler, and is tapped for connection to a pipe to carry the discharging sludge and hot water down between the wheels. This opening is closed by sliding a disc valve connected through a link to the crank on the end of the horizontal shaft. The shaft has teeth cut in it

which mesh with the teeth on a horizontal rack that has a piston head on either end. These pistons are provided with packing and have a steam tight fit in the cylinder. It will be seen that when air or steam pressure is admitted to one end of the cylinder, the movement of the pistons and rack revolves the crank shaft, which in turn moves the valve. When pressure is admitted to the opposite end of the cylinder the valve will be closed and the pressure in the boiler will keep it tightly seated. The crank shaft is extended through the casting and a lever, fastened to it, allows the manual operation of the valve at the engine house.

Several of these valves can be connected to the same operating valve in the cab, allowing them to be opened and closed at the same time.

SECTIONAL TUBE EXPANDER WITH KNOCKOUT ATTACHMENT

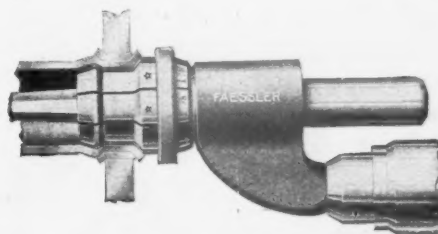
When using the ordinary sectional tube expander, it is necessary to strike the mandrel several blows on the side with a hand hammer to loosen it and remove the expanded. This frequently results in damage to the tool and sometimes requires considerable time and, at the best, it deteriorates the standard



Faessler Expander, Showing Position of Mandrel Extractor While Tube Is Being Expanded.

and the quality of the work. To eliminate this difficulty, the latest type of expander designed by the J. Faessler Manufacturing Company, Moberly, Mo., has a quick acting knockout. It consists of a sleeve fitted closely over the mandrel and having an extended arm to receive the blows of the hammer.

After the mandrel is forced in place either the pneumatic or hand hammer strikes the end of this arm and the effect of the blow is such that the sections are loosened from the mandrel, and at the same time the lever action tends to withdraw the mandrel. Theoretically each hammer impact on the arm forces the collar against the adjacent expander segment, and moves it slightly lengthwise before the balance of the segments are af-



Faessler Expander with Hammer Applied to Mandrel Extractor.

fect. The contact of the collar and expander segments forms a fulcrum around which the entire sleeve moves and imparts a slight lateral impulse to the mandrel which tends to break the contact with the other expander segments. This device does not in any way interfere with the expansion, and is usually allowed to remain on the mandrel. It is found that it releases the mandrel much quicker than can be done by hand, and it does not jump out, but simply creeps backward with the greatest safety and convenience. Its use results in a decided increase in the number of tubes that a man can expand in a given time.

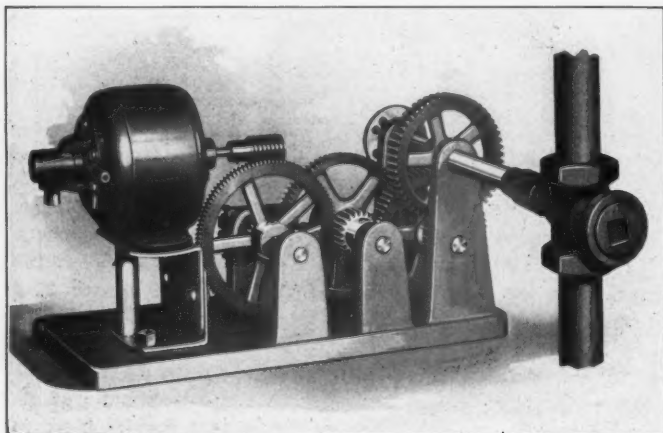
AUTOMATIC TEMPERATURE REGULATOR

Most of the first class passenger equipment now in service has electric current available at all times. This condition makes possible the application of a convenient method of regulating the temperature when the heating is by steam and from the locomotive, or by the use of Baker heaters.

A simple apparatus for performing this service has been designed by the Railway Utility Company of Chicago, and in the case of ordinary passenger cars consists of a sensitive mercury thermometer which has a platinum wire fused in the tube at the point reached by the mercury column when the temperature is 72 deg. Another similar wire is fused in the mercury bulb at the bottom. These two wires connect to the regulator of a small motor, which by a chain of gears operates the valve in the steam line. The arrangement is such that when the circuit to the thermometer is open the motor keeps the valve in the steam line open. When, however, the temperature reaches 72 deg. the mercury column in the thermometer closes the circuit and the motor is operated in the opposite direction and closes the steam valve. In each case the motor runs just long enough to close the valve and the amount of current used is very slight. The motor and its gearing connecting to the valve are en-

closed in a dust-proof casing and secured under the body of the car, and the thermometer can be placed at any desired point in the interior.

For use in sleeping cars, which should be kept cooler at night than during the day, a thermometer with two contacts is arranged, the circuit being made through a plug which can be inserted at either point to give the desired temperature.

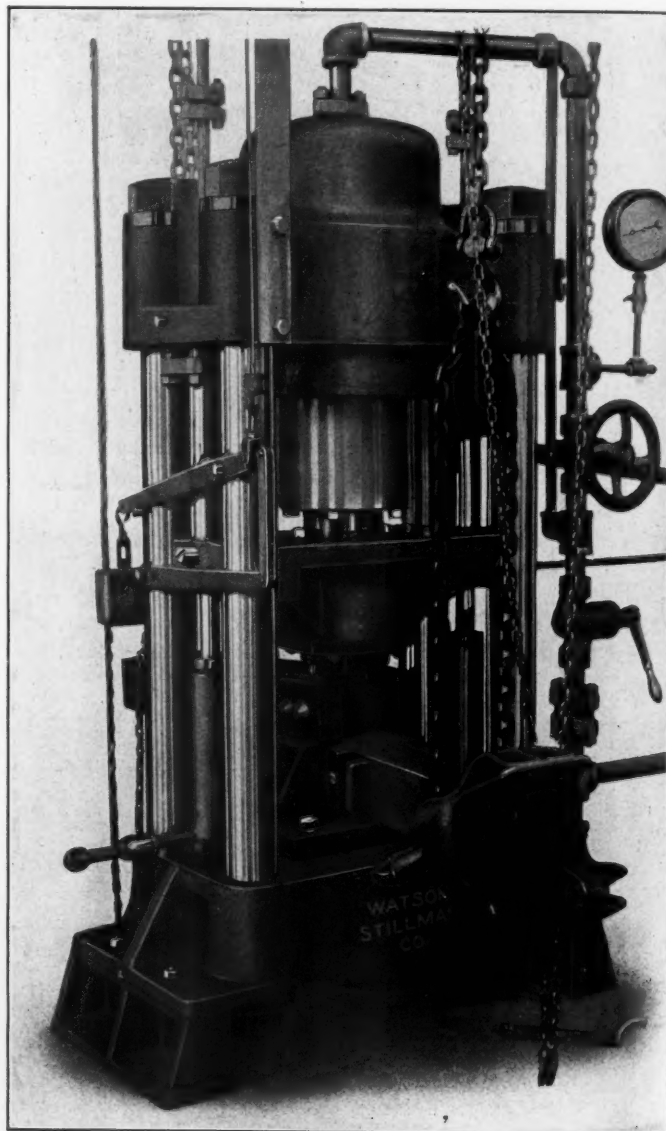


Apparatus for Closing and Opening the Valve in the Steam Line.

The same idea is carried still further for use in private cars where a thermometer may have several or more plugs for connection at different temperatures. In such cases each state-room would have a separate thermometer controlling the steam supply to individual radiators. When used in connection with Baker heaters the automatic control has the further advantage of preventing the burning out of the heater coils, which may occur when these cars are put in trains heated by a through steam line from the locomotive with the fire still burning in the heater. With vapor heating systems the valve in the heater line may be operated by a solenoid instead of a motor.

COUPLER YOKE SHEARING AND RIVETING PRESS

A powerful hydraulic press, designed and arranged particularly for the purpose of stripping yokes from coupler shanks and of riveting them on again, has been designed by the Watson-Stillman Company, New York, and is shown in the accom-



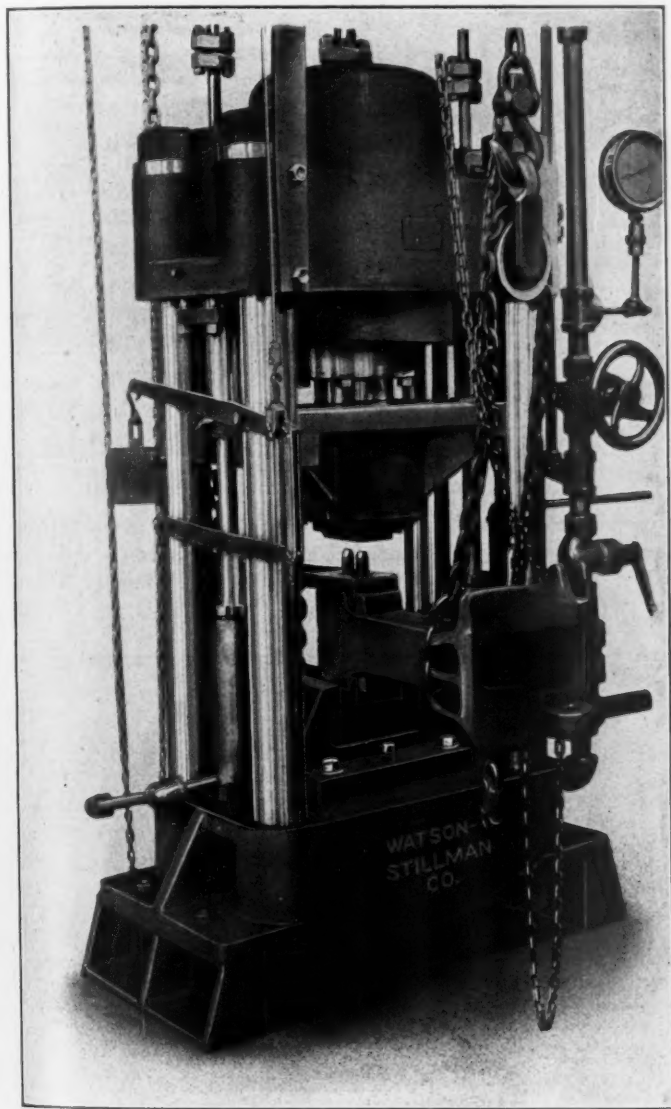
Press at the Completion of the Shearing Operation.

panying illustrations. Either operation, shearing or riveting, is effected by a single stroke of the ram, and the press is designed to handle standard coupler shanks up to 5 in. x 7 in., and will head rivets up to 1 1/4 in. diameter.

The body of the press is built in the most substantial man-

ner and ample room is provided for handling the work in and out. The press has a capacity of 200 tons, and is 6 ft. 8 in. in total height. The main ram has a diameter of 12 in. and a stroke of 6 in., and the clamping cylinders have 3 in. rams with $6\frac{1}{2}$ in. stroke. There are two push-back cylinders for a more rapid return of the large ram. These are automatic in operation.

Specially designed blocks are furnished with the machine, and in the shearing operation the shank and yoke are laid on their sides and the downward stroke of the press simply pushes the shank out between the jaws of the yoke, thus shearing the



Press Ready for Riveting Yoke to Coupler.

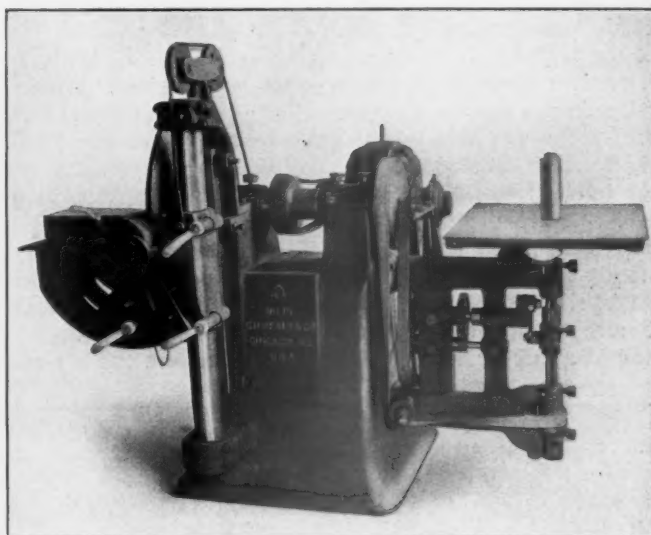
rivets and freeing the shank at one stroke. One of the illustrations shows the completion of this operation. For riveting, the coupler and shank with the rivets in place are set upright, and on opening the valve the small rams first clamp the yoke to the shank and then the large ram descends on the rivets and heads them. The start of this operation is shown in the second illustration.

DE WITT CLINTON TRAIN PASSENGER.—Mrs. Eliza C. Haywood, a passenger on the first railway train that was run in New York, recently died at Chicago at the age of 91. She was a passenger on the line between Albany, N. Y., and Schenectady in the summer of 1831, which was hauled by the old De Witt Clinton locomotive.

COMBINATION PATTERN MAKERS' GRINDER

A useful combination tool for a pattern making shop, is shown in the accompanying illustration. On one side of the central bed is a 30-in. disc grinder with its work table, while on the opposite side and driven from the same shaft is a vertical drum sander with an adjustable table. The latter is connected to the driving shaft by a clutch which permits it to be operated independent of the grinder. The shaft is connected to a three horse power motor by a 3-in. chain belt. In the illustration the machine is shown with all gear guards removed.

On the grinder side of the tool is a 30-in. steel wheel $\frac{3}{4}$ in. thick, which runs at 750 revolutions per minute. This has a work table 14 in. wide by 40 in. long, which may be tilted and locked at any angle from 75 deg. to 135 deg. Large distinct graduations permit the exact adjustment, and the construction is such that the inside edge of the table remains within $\frac{1}{32}$ in. of the disc regardless of its angular position. The work table also has a vertical adjustment of 25 in., and is supported by a round ver-



Combination Pattern Maker's Grinder.

tical shaft which permits it to be swung away from the grinding disc for convenience when setting the wheel or when facing off extra large patterns. There is a groove in the center of the table for the application of different attachments, four of which are furnished with the machine. These consist of a sizing circle gage for cylindrical and conical grinding, a sliding bevel gage for simple and compound angle grinding, a sizing bevel gage for simple and compound angle grinding to dimensions, and an angle plate for free-hand cornering of thin work. These attachments in combination with the possible movements of the table allow practically any kind of finishing work to be done with the machine. The disc carries an abrasive face that is cemented onto the steel plate, and it is not necessary to remove it for the application of a new grinding surface.

On the opposite side of the machine the drum sander has a work table 24 in. x 28 in., which may be tilted and locked at any angle from 85 deg. to 105 deg. from the axis of the sander. Here also a graduated scale is provided for accurate adjustment. The work table has a center round opening $8\frac{1}{2}$ in. in diameter in which are fitted circular plates with center holes to accommodate various sizes of drums from 1 in. to 6 in. in diameter. The sand drum runs at 2,250 revolutions per minute, and has a perpendicular reciprocating movement while running which can be adjusted between zero and 4 in. The drum spindle is driven by a 2 in. quarter-turn belt, while the reciprocating crank is driven through gearing by $1\frac{1}{2}$ -in. belt.

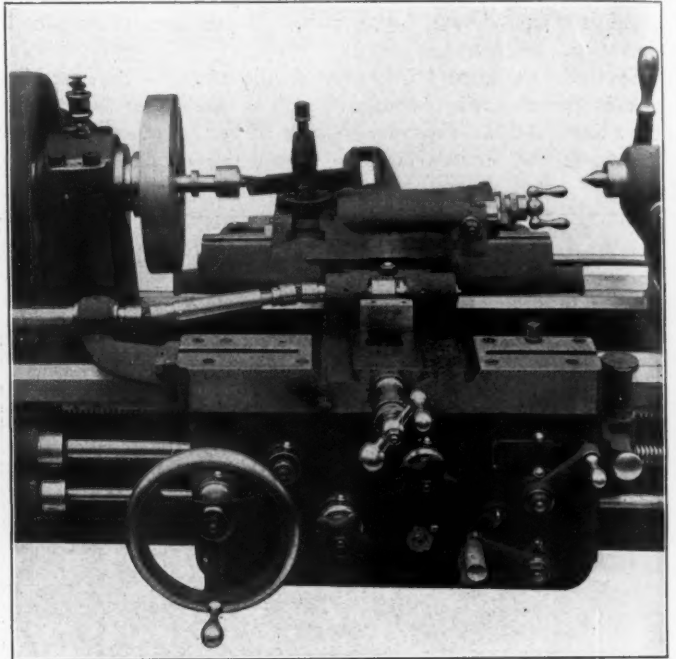
This machine occupies a floor space of 54 in. x 84 in., and weighs 2,800 lbs. It may be either belt or motor driven and is manufactured by C. S. Besley & Company, Chicago.

ATTACHMENTS FOR TOOL ROOM LATHES

The American Tool Works Company, Cincinnati, Ohio, has provided a number of attachments on 14 in., 16 in., 18 in., and 20 in. standard high duty lathes, which make them especially suited to tool room work. Since the basis of these lathes is a standard machine any of the attachments may be applied with very little trouble to the same size machines already in service.

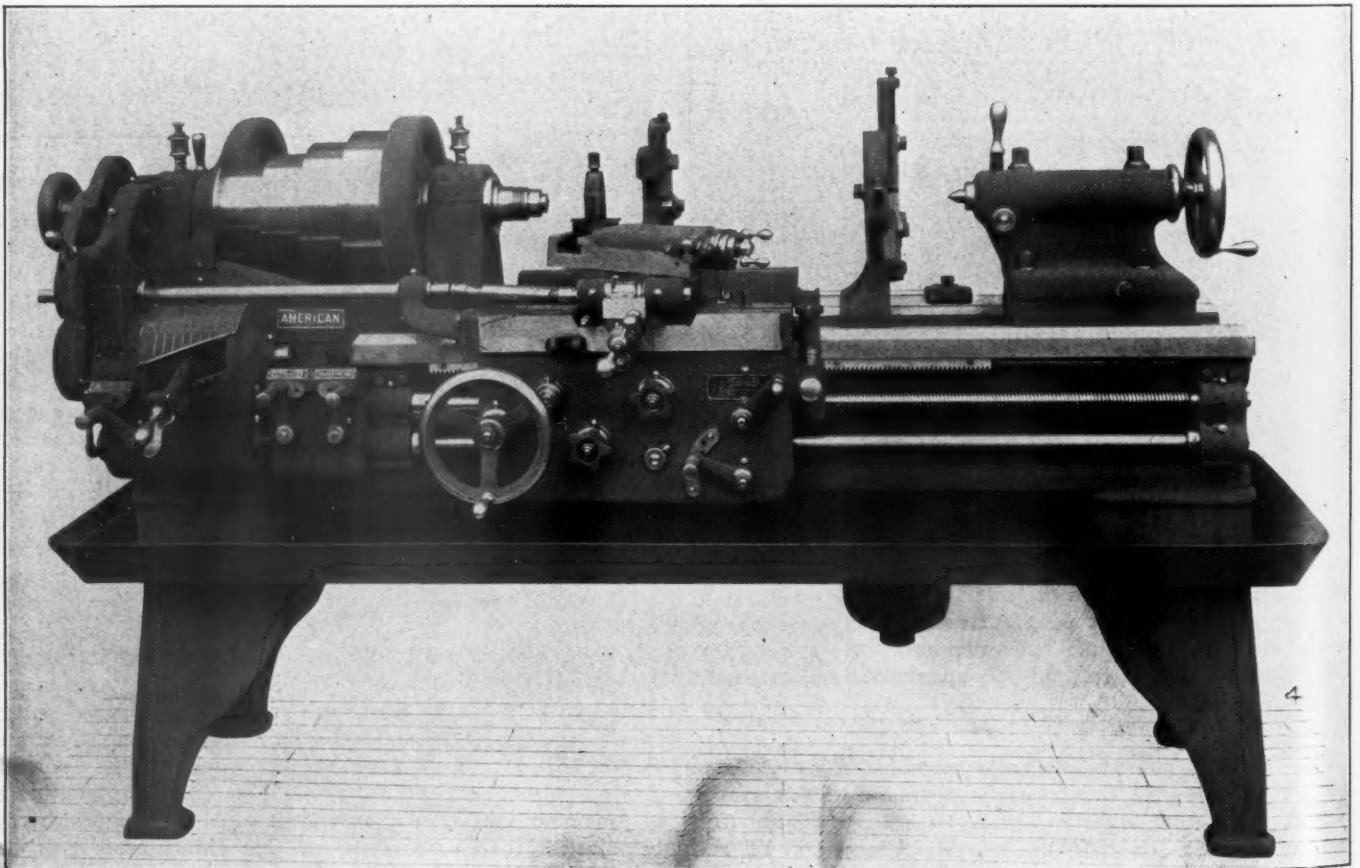
The most prominent of these special features is the relieving attachment which is designed to relieve or back off the flutes of rotary cutters, taps, reamers, end mills, hollow mills, dies, etc. This arrangement is universal in its action and internal relieving can be as easily performed as straight work. It is marked by an extreme simplicity in design, having but a few parts. The attachment is driven through a change gear mechanism supported by a bracket at the front of the headstock. The gear train has a small quadrant that is used to disengage the drive when not required. Power is taken from a spur gear on the end of the spindle and is transmitted through the change gear mechanism to the driving shaft which is journaled in a suitable bracket fastened to the left end of the carriage. Between this bracket and the tool rest are the universal joints which permit the cross movement of the tool slide. The driving shaft revolves constantly in one direction until the direction of the spindle is reversed at which time it ceases to operate. This valuable feature results from the use of a clutch between the cam and the driving shaft which is operative in one direction

only. There are three cams provided in addition to the change gears, giving the attachment an extremely wide range. The cams run in an oil bath and are located directly in front of the tool slide, permitting them to be readily in-



American Lathe, Showing End Relief Attachment.

terchanged. Possibly the most important and valuable feature of this new attachment is that which permits the tool slide to be operated at every 30 degrees, thus providing twelve operating positions within a circle. This permits the



American High Duty Tool Room Lathe with Taper, Relieving and Draw-In Attachments, and Oil Pan.

relieving of side cutters, end mills and numerous jobs that have heretofore been done by hand. Convenient means are provided for the adjustment to obtain the various degrees of relief desired. This attachment can be applied to any "American" high duty lathe below the 24 in. medium pattern size.

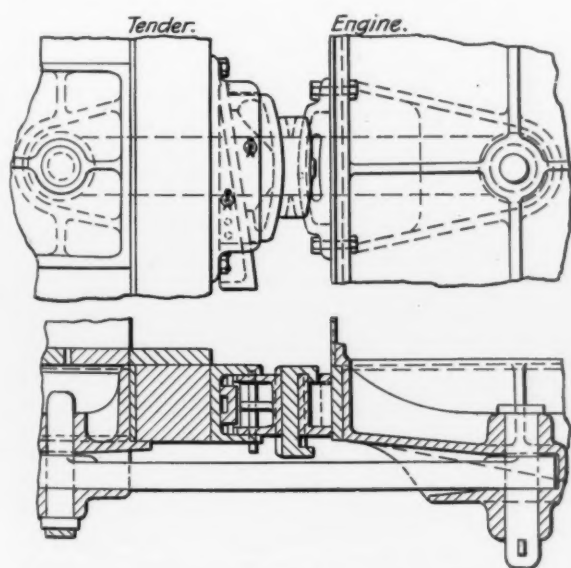
Another special feature provided on the tool room lathe is a very simple design of taper attachment. This is bolted to the carriage and travels with it, and can be instantly thrown in operation by the tightening of one bolt. When ready for taper work the sliding shoe of the attachment is directly connected to the bottom slide of the tool rest by a heavy cast iron yoke. It is not necessary to disconnect the cross-feed nut when using this arrangement.

The draw-in attachment furnished with these lathes is simple, consisting of a long hollow steel bar, a hardened and ground steel taper bushing and as many collets as are necessary for holding the different diameters of work. The hollow bar which extends through the spindle has a handle wheel at one end and is threaded internally at the other. The bushing fits in the spindle nose and the collets are placed within it, the threaded end extending through and connecting with the long bar. The stock to be turned is passed through from the head end of the lathe and is gripped in the collet or chuck. The turning of the hand wheel one way or the other permits the work to be engaged or disengaged.

A sheet iron oil pan to catch the waste lubricant and prevent it from running over the floor is a usual and important attachment for a tool room lathe and has been applied in this case.

RADIAL ENGINE AND TENDER BUFFER

With the commonly used type of spring buffer between the locomotive and its tender, the wear on the drawbar pins and the holes, as well as on the face of the buffer, is considerable and requires frequent attention for proper maintenance. In many cases this is not followed up carefully, and it is not uncommon to find locomotives running without any compression



Application of "Radial" Buffer Between Engine and Tender.

in the buffer springs. This not only makes a hard riding locomotive, but causes excessive strains to be brought on the drawbar and increases the possibility of derailment.

For the purpose of overcoming these difficulties, a type of radial buffer has been designed by the Radial Buffer Company, New York, which does not use springs but has a wedge behind the tender buffing plates which permits the blocks to be ad-

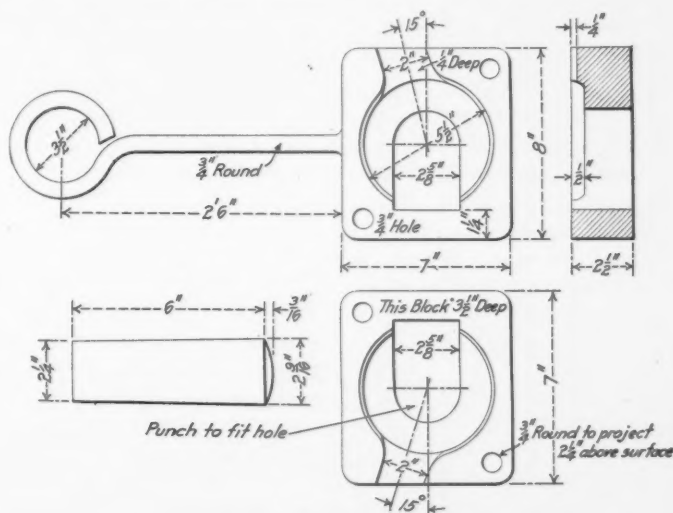
justed to suit the length of the drawbar. The faces of the buffer on both the engine and tender are radial with the pin centers and between them is a floating block which gives a large bearing surface, independent of the relative position of the two blocks. Reference to the illustration will show the arrangement and construction. Service tests have indicated that the wear on faces and buffers, as well as on the drawbar pins and holes, will be small. This buffer can be run with not to exceed 1/16 in. slack, and thus practically makes the locomotive and tender act as one piece.

FORGING FLAT WRENCHES

BY SAM LEWIS.

Foreman Blacksmith, Grand Trunk Pacific, Rivers, Manitoba

A light flat wrench, so designed that it can be used in awkward places, is a handy tool for a mechanic and if it is well made considerable time will be saved and the bolts and nuts will be more carefully adjusted. The design shown in the accompanying illustration is satisfactory and may be easily forged. A ball is first formed on each end of the rod with a pair of swages, under a steam hammer. These are made in one heat and the rod is



Dies for Shaping Flat Wrenches.

drawn out at the center. After a quantity have been made they are placed in the furnace and the ball ends are flattened to fit the dies of the different size wrenches. The punch and die shown herewith are used for making a wrench for a 1 1/2 in. nut. The diameter of the ball at the end of the rods should vary for the different sizes. For a 1 in. wrench the ball should be 3/4 in. in diameter for a 7/8 in., 2 1/4 in., and for a 1 1/2 in., 3/4 in.

MEXICAN WAY OF HANDLING A STRIKE.—Anticipating a strike of the American conductors and enginemen employed on the National Railways of Mexico, which had been called for 5 o'clock on the afternoon of April 17, on account of an alleged policy of discrimination against American employees in order to eliminate them from the service, the management issued an order discharging them at 3 o'clock on the afternoon of the 16th, just 26 hours in advance of the time set for the strike. According to press reports, the order found many of the men at distant points on the system; and, four days before, an order had been issued cancelling all passes for American employees and members of their families. About 1,000 American enginemen and conductors are said to have been affected. All trains run after the issuance of the order were manned entirely by Mexicans, but for a time it was necessary to abandon a part of the service.

GENERAL NEWS SECTION

The Pennsylvania Railroad has spent more than \$100,000 during the year 1911 in its campaign against trespassing. This is nearly one-fifth of the cost of maintaining the company's police force.

The Illinois Central made its first settlement under the Illinois workmen compensation law on July 22, when it paid \$3,500, the maximum under the law, for the death of a brakeman, who was killed June 4.

The Boston & Maine has issued rules against making bonfires on the company's property and forbidding the emptying of ashes into wooden receptacles, and smoking where inflammable materials are used. Spark arresters with a 3/16 in. mesh have been installed on nearly all locomotives, and these are to be inspected each week.

Both the Delaware, Lackawanna & Western and the Chicago & Alton have issued orders to the employees of the operating department, stating that the use of intoxicating liquors while on or off duty will be considered sufficient cause for dismissal. The Lackawanna goes a step further by prohibiting its men from visiting places where liquor is sold and enjoins them to use their time off duty so as to obtain sufficient rest from their labors.

The relief department of the Pennsylvania Railroad system reports that \$180,577.73 was paid to the employees during the month of July, 1912. Of this amount \$127,428.78 represents the payments made on the lines east of Pittsburgh and Erie, Pa. Since the establishment of the fund a total of \$33,704,578.52 has been paid out. On the Lines East of Pittsburgh \$31,407.33 was paid to families of members who died during last July, and \$12,750 was paid on the Lines West.

Efficiency committees have been organized on the Pere Marquette to investigate various subjects assigned to them. The following chairmen have been appointed: Train Tonnage, J. F. Deimling, chief engineer; Per Diem and Demurrage, H. O. Halsted, superintendent of transportation; Fuel Consumption and Train Supplies, W. L. Kellogg, superintendent motive power; Shop and Store Practice, W. C. Atherton, purchasing agent. These chairmen will report to F. H. Alfred, assistant general manager.

An examination for the position of engineer of tests at the Watertown Arsenal, Mass., with a salary of \$2,000 a year, will be conducted September 21 by the United States Civil Service Commission. The applicants must have had three years' experience, with some experience in testing engineering material, and must have been graduated from civil or mechanical engineering schools. Examinations for engineer draftsmen will be held September 11 and 12 in the supervising architect's office in the treasury department, the salaries ranging from \$1,600 to \$2,000.

A general safety committee has been inaugurated on the Illinois Central. It will consist of assistant general manager T. J. Foley as chairman; the superintendent of machinery, the engineer of maintenance of way, the chief claim agent, the chief surgeon and the general attorney. Meetings will be held every month in the office of the assistant general manager for the purpose of discussing methods that will prevent accidents. Division committees have been appointed which will hold conferences every month, and the chief claim agent will furnish evidence concerning the accidents happening through the month and they will be thoroughly discussed. Twenty-five hundred safety buttons bearing the motto "Always Safety First" are being distributed among the employees of both the Illinois Central and the Yazoo & Mississippi Valley.

The Missouri Pacific-Iron Mountain system has given the control of its hospital system to the employees of that road. The system includes large hospitals in St. Louis, Kansas City and Little Rock, a joint arrangement with the St. Louis Southwestern at Texarkana, Ark., for the use of its hospitals there, and arrangements at more than 30 other points along the line with sanitariums which look after the sick and disabled for the company. The railway company had to advance funds to establish this system, but small fees collected have placed the service on a self-sustaining basis, so that it can be legitimately turned over to the employees for their own management. The chief surgeon of the road, Dr. Paul F. Vasterling, is chairman of the board of managers.

Max H. C. Brombacher, an efficiency engineer of New York City, recently returned from a trip to Europe, where he spent six or seven months in making a study of the railway shops of England and the continent, with special reference to shop management. Mr. Brombacher will present his findings to the Interstate Commerce Commission in the form of a report which will include a large amount of statistical data. He visited the principal shops and headquarters of the railways of England, Switzerland, France, Grand Duchies of Baden and Hessen-Darmstadt, and the Kingdoms of Bavaria, Prussia, Saxony, Wurtemberg and the Austrian Empire. He reports that there should be a very good market for American machine tools abroad, as they are far superior to those he noticed in operation in industrial plants.

The United States Bureau of Mines makes the statement in a bulletin just issued that the present steaming capacities of steam boilers can be tripled or quadrupled by forcing over the heating surface three or four times the weight of gases now passed over them. "With well-designed mechanical-draft apparatus this greater weight of gases can be forced through the boilers at small operating cost," the bulletin states. "It is possible to increase the capacity of many of the present boilers in this way without reducing their efficiency much; in fact, by proper arrangement of the heating surfaces the efficiency can be made higher than the present rating. The efficiency of any boiler can be increased by arranging its heating surfaces in series with respect to the path of hot gases. New boilers of high efficiency can be constructed by making the cross section of the gas passages small in comparison with the length." These statements are contained in Bulletin 18 on the Transmission of Heat Into Steam Boilers, the authors being Henry Kreisinger and Walter T. Ray.

EMPLOYEES AND THEIR SAFETY.

H. W. Belnap, chief inspector of safety appliances, Interstate Commerce Commission, gave an address before a meeting of the Baltimore & Ohio employees at Philadelphia on the Employees' Responsibility for Their Own Safety. The keynote of the whole address may be taken from the following abstract:

No law, no matter how rigidly enforced, can correct evils that are directly chargeable to failure of employees themselves to do their duty and to exercise due precaution not alone for their own safety, but also for the safety of others. We know that employees often fail to exercise ordinary precaution in the performance of their work. This failure is often a form of thoughtlessness in which the chief motive is haste, and generally it is true that some ease or saving of time to themselves is secured by almost every unnecessary risk they take.

The use of safety appliances on cars is an important factor in the prevention of accidents. The commission's records show that of the total deaths and injuries suffered by trainmen in

1893, 44.33 per cent. were due to coupling and uncoupling cars. This percentage has steadily decreased from year to year until in 1911 it was but 6.3 per cent.

A thoughtful and active mind is the first necessity for safety, but in the hazardous occupation of train operation it seems that attention to safety has been secondary and occasional instead of continuous and of prime importance. If we can instill the idea that it is more honorable and more professional to be cautious and prudent than to take unnecessary risks a great reduction in the accident records will result.

DOUBLE DECK STREET CAR

Experimental double deck street cars have recently been placed in service in both New York and Pittsburgh. A few double deck cars have been built previously for special purposes in this country, but have not proved a success because of the height of the car being too great to afford a proper clearance for the overhead trolley wire, and also because of the delays in handling the passengers to and from the upper deck. The combination of an upper deck with the stepless car, which was recently introduced in New York City, makes the New York double deck car only a little higher than the standard street cars, the distance from the top of the rail to the top of the car being less than 13 ft. This car was designed by Frank Hedley, manager, and J. S. Doyle, superintendent of car equipment of the New York Railways Company, and was built by the J. G. Brill Company. It is 44 ft. long and 8 ft. 3 in. wide, and has a seating capacity for 88, 44 of these being in the lower part of the car. The total seating capacity has been found by actual experiment to be 171 passengers. This makes the weight of the car per passenger about 266 lbs.

The Pittsburgh car was built in the repair shops of the Pittsburgh Railways Company from the bodies of two short open cars from which the platforms had been removed. This car has been arranged with two side entrances and is 48 ft. long and 14 ft. 3 in. high from the top of the rail to the top of the car. Unlike the New York car, which has the stairways at either end, the stairs are in the center of the car. One of the side entrances is used for an entrance and the other for an exit. The seating capacity of the upper deck is 52 and the lower one 60, a total of 112. The greatest number of passengers carried in actual service has been 184, but the car was planned for a maximum seating capacity of 208.

SAFETY COMMITTEES

A large number of safety committees have recently been appointed on the railways in this country. The Union Pacific has established a system which is comprised of a central safety committee, division committees and district shop committees. The central committee will be permanent, consisting of the four general managers. Each division committee includes the superintendent and members of his staff and ten or more employees. The district shop committees will consist of one employee from each of the different branches of shop work and one from the general store.

The Oregon Short Line has inaugurated a safety campaign, which is similar to that of the Union Pacific, the division committees being empowered to appoint sub-committees to make special reports.

The safety committee on the Oregon-Washington Railroad & Navigation Company consists of a central committee which includes one assistant general manager as chairman, all the other assistant general managers, superintendent of water lines, general storekeeper, assistant general attorney, general claims agent, and chief surgeon. There are division committees consisting of the division superintendents and their staffs and a district shop committee similar to that of the Union Pacific. Each committee will meet once a month, and special meetings may be called at any time.

The Southern Pacific of Mexico and the Sonora Railway or-

ganized safety committees August 1. The general committee includes the general superintendent as chairman, one assistant general superintendent as vice-chairman and secretary, one assistant general superintendent, general freight and passenger agent, chief surgeon, master mechanic, superintendent of the Sonora division, and the attorney at Guaymas. There are also division committees appointed for each division.

The safety organization on the Lehigh Valley presents a new feature. A prize will be awarded in each department, on each division, every year to the employee who makes the best suggestion towards improvement in safe operation. The prize will consist of a month's vacation with pay, and the winner will also receive an honor button, to be retained by him as long as he remains on the honor roll. The members of the general safety committee are the general manager, the superintendent of transportation, superintendent of motive power, the maintenance of way engineer, the claims attorney, and an officer or employee appointed by the general manager. The division committees will be made up of officers and employees.

The central safety committee on the Southern Pacific will be composed of division superintendents, and on each division there will be a committee composed of the superintendent and members of his staff from the various departments, with employees from the different classes of work. Each of these employees will be chairman of another district committee, who will report the work of the sub-committees to the central committee.

The Cincinnati, Hamilton & Dayton has started a "safety first" campaign, which will be similar to that of its parent company, the Baltimore & Ohio.

The Rock Island has organized a safety bureau which will consist of several committees composed of general district and division officers, district safety supervisors, and a large number of employees from the rank and file in the various departments, the total membership approximating 600. L. F. Shedd has been appointed general safety supervisor, with headquarters in Chicago. He will have charge of the safety organization. The general safety committee will be composed of the assistant to the second vice-president, as chairman, the general managers of the three districts, the chief engineer, claims attorney, general claim agent, chief surgeon and general safety inspector, who will act as secretary. The district safety committees will be composed of the district officers with the assistant general managers as chairmen, and the division safety committees of division officers and employees with the division superintendents as chairmen. There will also be terminal, division and shop safety committees at the principal terminals and shops.

The Indiana State Railway Commission has issued a statement that safety committees have been established by all railways operating in that state, except the Grand Trunk and the New York, Chicago & St. Louis.

CARS FOR THE REFRIGERATOR PACIFIC FRUIT EXPRESS

One thousand new refrigerator cars, equipped with collapsible tanks with a capacity of 11,000 lbs. of ice, will soon be delivered to the Pacific Fruit Express Company, a subsidiary of the Southern Pacific Company. The collapsible tanks will enable the company to use the cars for ordinary freight during the periods that they are not required for perishables. The first instalment of these new cars will soon be started westward, and they will immediately go into service. This order of 1,000 new cars is an increase of 10 per cent. in the total refrigerator equipment of this company, making it 11,000 cars. The latest refrigeration ideas have been adopted in the building of the cars and a most effective insulation will line the interiors. Five years ago the Pacific Fruit Express Company had 6,600 of these cars, but the growing fruit and produce business of California, Oregon, Washington, Idaho and other Pacific coast states has caused nearly a thousand additional cars to be purchased annually.

MEETINGS AND CONVENTIONS.

New York Railroad Club.—A. W. Whiteford will read a paper on the Relation of Boiler Design to Evaporation and Safety at the meeting which is to be held on Friday evening, September 20. It will deal with the low water and other tests made at Coatesville, Pa., under the direction of Dr. W. F. M. Goss and will be accompanied by lantern slides.

Central Railway Club.—The next regular meeting will include the fall outing of the club, and will be held at Dunkirk, September 12. The club will go from Buffalo to Dunkirk by boat, leaving the former place at 9.30 a. m., arriving at Dunkirk about 12.30 p. m. The plant of the American Locomotive Company will be visited and a paper will be read by Henry Gardner, supervisor of apprentices of the New York Central, on a Practical Application of the Routing System to Locomotive Repairs.

American Society of Mechanical Engineers.—It is expected that this society will give considerably more attention to railway subjects in the future than it has in the past. The Committee on Meetings recently appointed a number of sub-committees on the industries, one of which was on the railroads. The personnel of the committee is as follows: E. B. Katte, chairman; George M. Basford, T. N. Ely, Dr. W. F. M. Goss, W. B. Potter, N. W. Storer, H. H. Vaughan and R. V. Wright. There is a possibility of one of the sessions of the annual meeting in December being entirely given over to a discussion of subjects of special interest to railways.

Illuminating Engineering Society.—The sixth annual convention of the Illuminating Engineering Society will be held at the Hotel Clifton, Niagara Falls, Ont., September 16 to 19. A large number of papers and reports will be presented. A report on Progress deals with recent developments in the lighting industry, both in this country and abroad. There will also be reports on Nomenclature and Standards and on Steel Mill Lighting. Among the individual papers which will be read are those on Indirect and Semi-Indirect Illumination; Diffuse Reflection; A Study of Natural and Artificial Light Distribution in Interiors; The Physiology of Vision; The Efficiency of the Eye Under Different Systems of Illumination; Illumination Charts, and the Determination of Illumination Efficiency. The office of the general secretary of the society, Preston S. Millar, is at 29 West Thirty-ninth street, New York City.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting of mechanical associations.

- AIR BRAKE ASSOCIATION.**—F. M. Nellis, 53 State St., Boston, Mass. 1913 convention to be held at St. Louis, Mo.
- AMERICAN RAILWAY MASTER MECHANICS' ASSOC.**—J. W. Taylor, Old Colony building, Chicago.
- AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.**—A. R. Davis, Central of Georgia, Macon, Ga.
- AMERICAN SOCIETY FOR TESTING MATERIALS.**—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.
- AMERICAN SOCIETY OF MECHANICAL ENGINEERS.**—Calvin W. Rice, 29 W. 39th St., New York.
- CAR FOREMEN'S ASSOCIATION OF CHICAGO.**—Aaron Kline, 841 North 50th Court, Chicago; 2d Monday in month, Chicago.
- INTERNATIONAL RAILWAY FUEL ASSOCIATION.**—C. G. Hall, McCormick building, Chicago.
- INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.**—William Hall, Chicago & North Western, Escanaba, Mich.
- INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.**—A. L. Woodworth, Lima, Ohio.
- MASTER BOILER MAKERS' ASSOCIATION.**—Harry D. Vought, 95 Liberty St., New York.
- MASTER CAR BUILDERS' ASSOCIATION.**—J. W. Taylor, Old Colony building, Chicago.
- MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOC. OF U. S. AND CANADA.**—A. P. Dane, B. & M., Reading, Mass. Convention, September 10-13, Albany Hotel, Denver, Col.
- RAILWAY STOREKEEPERS' ASSOCIATION.**—J. P. Murphy, Box C, Collinwood, Ohio.
- TRAVELING ENGINEERS' ASSOCIATION.**—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y.

PERSONALS

It is our desire to make these columns cover as completely as possible all the changes that take place in the mechanical departments of the railways of this country, and we shall greatly appreciate any assistance that our readers may give us in helping to bring this about.

GENERAL.

HENRY ALLEN has been appointed assistant boiler inspector of the Alberta division of the Canadian Pacific.

ALLEN HARWOOD BABCOCK, who has been appointed consulting electrical engineer of the Southern Pacific Company, with office at San Francisco, Cal., was born August 12, 1865, at Buffalo, N. Y. He attended the public schools at Oakland, Cal., Phillips Exeter Academy, the University of California and Lehigh University. In November, 1891, Mr. Babcock became a draftsman in the San Francisco office of the Thompson - Houston Electric Company, and was made assistant engineer of the same company in December of the following year. He went with the Standard Electric Company of California in July, 1898, where he was assistant engineer until May, 1899, and was then promoted to superintendent. In



A. H. Babcock.

June, 1901, he was appointed electrical engineer of the California Central Gas & Electric Company; in July, 1902, he went with the North Shore Railroad as electrical engineer, and from December, 1903, until the date of his recent promotion to consulting electrical engineer, he was electrical engineer of the Southern Pacific Company, with office at San Francisco.

A. J. BAUMBUSH has been appointed general foreman of the New York Central & Hudson River, at the Grand Central Terminal, New York. He will be in charge of inspection, repairs and cleaning of all equipment entering the terminal, whether owned by the New York, New Haven & Hartford or the New York Central.

E. L. BURDICK, assistant engineer of tests of the Atchison, Topeka & Santa Fe, with office at Topeka, Kan., has resigned to go with one of the Westinghouse companies. Effective September 1.

H. G. BURNHAM, chemist and engineer of tests of the Buffalo, Rochester & Pittsburgh, at Du Bois, Pa., has been appointed engineer of tests of the Northern Pacific, with headquarters at St. Paul, Minn.

C. C. CORKRAN has been appointed chief clerk of the motive power department of the Chesapeake & Ohio at Richmond, Va.

S. J. DILLON, master mechanic of the Trenton Terminal division of the Pennsylvania Railroad at Camden, N. J., has been appointed master mechanic of the West Jersey & Seashore and the Camden Terminal division, with headquarters at Camden, N. J., succeeding F. G. Grimshaw, promoted.

F. A. FAIRLIE has been appointed locomotive superintendent of the Nitrate Railway, Ltd., with office at Iquique, Chile.

J. A. FARLEY has been appointed accountant of the motive power department of the Chesapeake & Ohio, at Richmond, Va.

J. R. SEXTON, who has been appointed mechanical superintendent of the Northern district of the Western lines of the Atchison, Topeka & Santa Fe, with office at La Junta, Colo., as announced in our August issue, was born in New England on April 5, 1863, and was graduated from the public schools of Plattsmouth, Neb., in 1879. He began railway work in April of the same year as machinist apprentice for the Chicago, Burlington & Quincy. After completing his apprenticeship he was a machinist in various shops for three years from 1883, and from November, 1886, to January, 1890, he was erecting and roundhouse foreman of the Burlington at Plattsmouth. He was then promoted to general foreman at Alliance, Neb., and went to the Great Northern as district foreman at Devils Lake, N. D., in April, 1901. He was with the Union Pacific at Cheyenne, Wyo., from November, 1902, to June, 1904, first as roundhouse foreman and then as general foreman. On June 24, 1904, Mr. Sexton went with the Atchison, Topeka & Santa Fe, with which road he has been consecutively general foreman at Cleburne, Tex., until November 15, 1910, and master mechanic of the Missouri division at Shop-ton, Iowa, from the latter date until June 1, 1912, when he was promoted as noted above.

Frank Zeleny, whose appointment as engineer of tests of the Chicago, Burlington & Quincy, with headquarters at Aurora, Ill., was announced in our August issue, was born December 5, 1876, at Hutchinson, Minn. He attended the University of Minnesota from 1894 to 1898, graduating with the degree of mechanical engineer. In September, 1898, he began railway work with the Chicago, Burlington & Quincy, where he was a special apprentice until January 17, 1902. On the latter date he was appointed assistant to the superintendent of shops at Aurora, which position he held until July 3, 1912, the date of his appointment as engineer of tests of the same company with headquarters at Aurora. At the direction of a committee appointed by the Master Mechanics' Association in June, 1899, to ascertain to what extent the recommendations of the association were put in practice, Mr. Zeleny prepared an alphabetical and a classified index of the subjects of all re-

ports, papers and discussions from the formation of the association in 1868 to that time.

GEORGE B. FOOTE, chief timekeeper for shop accounting of the Lake Shore & Michigan Southern, at Collinwood, Ohio, has been appointed chief clerk to the master mechanic at Cleveland, Ohio.

ROBERT ROBERTSON, who has been for some time in the mechanical department of the Guayaquil & Quito, at La Tacunga, Ecuador, has been appointed superintendent of motive power and floating equipment, with headquarters at Huigra, succeeding C. O. Bertsch, resigned.

J. G. SMITH has been appointed assistant locomotive superintendent of the Nitrate Railways, Ltd., with office at Iquique, Chile.

ARTHUR SQUIRES has been appointed chief mechanical engineer of the Chilean State Railways, with office at Santiago, Chile.

J. H. TURNER, chief clerk to the master mechanic of the Lake Shore & Michigan Southern at Cleveland, Ohio, has been appointed chief clerk to the division superintendent, with headquarters at Cleveland, Ohio.

S. J. WAGAR has been appointed chemist and engineer of tests of the Buffalo, Rochester & Pittsburgh, vice H. G. Burnham, resigned to accept service in a similar position on the Northern Pacific.

MASTER OF MECHANICS AND ROAD FOREMEN ENGINES

JOHN W. BRANTON, general foreman of the Illinois Central at Mounds, Ill., has been appointed master mechanic of the Centralia district, with office at Centralia, Ill., succeeding R. H. Horn, assigned to other duties.

F. L. CARSON has been appointed master mechanic of the San Antonio & Aransas Pass, with office at Yoakum, Tex., succeeding T. F. Sullivan, resigned.

J. A. CLOUGH has been appointed master mechanic of the Southwestern Railway, with headquarters at Archer City, Texas.

C. C. ELMES has been appointed master mechanic of the Texas & New Orleans, with office at Houston, Tex., succeeding F. Galvin.

J. O. ENOCKSON, formerly roundhouse foreman of the Chicago, St. Paul, Minneapolis & Omaha, at Altoona, Wis., has been appointed master mechanic, with headquarters at Sioux City, Iowa.

W. S. GADEN, general foreman of the Southern Railway at Memphis, Tenn., has been appointed master mechanic of the Memphis Union Station Company, Memphis, Tenn.

J. HAYWARD has been appointed locomotive foreman of the Canadian Pacific at North Bend, B. C., vice C. H. Tedlock, resigned.

R. A. JONES has been appointed district master mechanic of the Canadian Pacific at Saskatoon, Sask., vice J. D. Watson, resigned.

W. A. KLINE, locomotive engineer of the Central of Georgia, has been made road foreman of engines of the Columbus division, with headquarters at Columbus, Ga.

C. A. LITTLE has been appointed locomotive foreman of the Canadian Pacific at Red Deer, Alta., vice D. G. McDonald, assigned to other duties.

W. H. MORTON has been appointed locomotive foreman of the Canadian Pacific at Rosebery, B. C., vice H. Ingram, resigned.

CAL SPAULDING, road foreman of engines of the East Iowa division of the Chicago & North Western, has been trans-



J. R. Sexton.



Frank Zeleny.

ferred to the West Iowa division, with headquarters at Boone, Iowa.

PERRY STARKS, road foreman of engines of the West Iowa division of the Chicago & North Western, has been transferred to the East Iowa division, with headquarters at Boone, Iowa.

ROBERT WALLACE has been appointed general road foreman of engines of the Cincinnati, Hamilton & Dayton, with office at Cincinnati, Ohio.

J. H. WOOD has been appointed road foreman of equipment on the St. Louis division and Kansas City Terminal division of the Rock Island Lines, vice G. G. Hoffman, resigned.

CAR DEPARTMENT

MONT AMOS, bonus inspector of the Atchison, Topeka & Santa Fe at Gallup, N. Mex., has been appointed assistant car foreman.

J. G. ARMSTRONG, rip track foreman of the Southern Railway at Birmingham, Ala., has been appointed chief car foreman, with headquarters at Memphis, Tenn.

JOHN BEIBER, assistant rip track foreman of the Atchison, Topeka & Santa Fe, at Richmond, Cal., has been promoted to coach foreman.

C. J. BURGOYNE has been appointed general foreman of passenger car inspectors for the Philadelphia Terminal division of the Pennsylvania Railroad, vice G. E. Strattan, promoted.

E. G. CHENOWETH, mechanical engineer of the Erie Railroad at Meadville, Pa., has been appointed assistant superintendent of the car department of the Chicago Terminal division of the Rock Island Lines, with office at the 124th street shops, Blue Island, Ill.

T. H. GOODNOW, general superintendent of the Armour Car Lines at Chicago, has been appointed assistant superintendent of the car department of the Chicago & North Western, with office at Chicago, succeeding C. H. Osborn, resigned to engage in other business.

WILLIAM H. HANSON has been appointed car foreman of the Chicago & North Western, with headquarters at Council Bluffs, Iowa.

J. A. LINN, assistant car foreman of the Southern Railway at Spencer, N. C., has been appointed car foreman of the El Paso & Southwestern, with headquarters at Douglas, Ariz.

J. L. MCCARTHY has been appointed assistant rip track foreman of the Atchison, Topeka & Santa Fe, at Richmond, Cal., vice John Beiber, promoted.

WILLIAM QUEENAN, formerly general foreman of the car department, has been appointed assistant superintendent of shops in charge of the car department of the Chicago, Burlington & Quincy, at Aurora, Ill.

FRED E. SUMMERS, bonus inspector on the repair track of the Atchison, Topeka & Santa Fe at Clovis, N. Mex., has been appointed car foreman, with headquarters at Vaughn, N. Mex., vice W. F. Tudor, deceased.

SHOP AND ENGINE HOUSE

JOHN D. BARTHELL has been appointed general foreman of the Illinois Central at Mounds, Ill., vice J. W. Branton, promoted.

J. BATHIE, boilermaker foreman of the Canadian Pacific at Cranbrook, B. C., has resigned.

JOE BIESER, boilermaker of the St. Louis Southwestern of Texas, has been appointed boiler shop foreman at Tyler, Tex., vice C. C. Shepherd, resigned.

J. L. BRALEY has been appointed erecting foreman of the Cedar Rapids, Ia., shops of the Rock Island Lines, vice W. T. Abington, promoted.

F. L. COLES has been appointed foreman of the locomotive department of the Rock Island Lines at Herington, Kans., vice H. F. Klinklaus, resigned.

PATRICK I. COSTILLO has been appointed night round house foreman of the Atchison, Topeka & Santa Fe, with headquarters at La Junta, Colo.

B. L. DAVIES, formerly assistant foreman of the Chesapeake & Ohio, at Russell, Ky., has been appointed general foreman, with headquarters at Hammond, Ind.

WILLIAM LINN DAVIS, night roundhouse foreman of the Atchison, Topeka & Santa Fe, at Eighteenth street, Chicago, has been made roundhouse foreman at Chanute, Kans.

HENRY DURTSCHKE, roundhouse foreman of the Erie, at Marion, Ohio, has been appointed general foreman, with headquarters at Kent, Ohio.

J. C. GOULDSBARRY, gang foreman of the Pittsburgh & Lake Erie at McKees Rocks, Pa., was recently appointed foreman at Beaver Falls, Pa.

W. E. GRAY has been appointed boiler shop foreman of the International & Great Northern at Palestine, Tex.

H. L. HAHN, formerly assistant foreman in the boiler department of the Atchison, Topeka & Santa Fe at Albuquerque, N. Mex., and later general boiler inspector of the Oregon Short Line, with headquarters at Salt Lake City, has been appointed foreman of the boiler department at Albuquerque.

L. A. HARDING, general foreman of the Chicago & North Western at Eagle Grove, Ia., has been promoted to night engine house foreman at Boone, Iowa.

F. C. HASBROUCH, formerly assistant roundhouse foreman of the Chicago & Eastern Illinois at Danville, Ill., has been promoted to the position of general foreman, with headquarters at Terre Haute, Ind.

WILLIAM H. HAWKER, locomotive engineer on the Chicago, St. Paul, Minneapolis & Omaha, has been appointed roundhouse foreman, with headquarters at Altoona, Wis.

WILLIAM H. JAMES, machinist on the Chicago & North Western, has been appointed roundhouse foreman at Council Bluffs, Iowa.

MARK JEFFERSON, gang foreman at the Sayre, Pa., shop of the Lehigh Valley, has been appointed general foreman of the shops at Buffalo, N. Y.

J. M. KILFOYLE, roundhouse foreman of the St. Louis Southwestern of Texas, has been appointed general foreman at Tyler, Tex.

W. C. LELAND, roundhouse foreman of the Southern Railway at Greenville, S. C., has been appointed roundhouse foreman of the El Paso & Southwestern at Douglas, Ariz.

GEORGE F. LINCK, machinist of the Atchison, Topeka & Santa Fe, has been appointed machine foreman at La Junta, Colo.

W. H. McAMIS, roundhouse foreman of the Central of Georgia, has been appointed general foreman at Columbus, Ga.

W. H. McDONALD, machinist on the Atchison, Topeka & Santa Fe at Clovis, N. Mex., has been appointed general foreman of the Florida East Coast at St. Augustine, Fla.

T. E. MERRITT has been appointed general foreman of the El Paso & Southwestern at Douglas, Ariz.

E. O. MILLER, foreman boilermaker of the Southern Railway at Sheffield, Ala., has been appointed general foreman, with headquarters at Memphis, Tenn.

H. E. MORROW has resigned as foreman on the International & Great Northern at Palestine, Tex., to engage in other business.

J. MULLEN has been appointed assistant engine house foreman of the Canadian Pacific at Cranbrook, B. C.

H. O. PALMER has been appointed foreman of the El Paso & Southwestern at Hachita, New Mexico.

A. A. POTIET, boilermaker of the Texarkana & Ft. Smith, has been appointed foreman, with headquarters at Port Arthur, Tex.

JAMES POWERS, machinist of the Lehigh Valley, has been appointed gang foreman in the Sayre, Pa., shop.

C. L. RITSMAN has been appointed machine shop foreman of the Wheeling & Lake Erie, with headquarters at East Toledo, Ohio.

CHARLES R. SHELLINGER, engineer of the Chicago & North Western has been appointed night roundhouse foreman, with headquarters at Council Bluffs, Iowa.

WEVER D. SMITH, who recently completed his apprenticeship, has been appointed machine foreman of the Atchison, Topeka & Santa Fe at Argentine, Kan.

EARNEST V. SMITH, boilermaker of the Seaboard Air Line, has been appointed foreman boilermaker at Jacksonville, Fla.

W. J. SPAULDING has been appointed foreman of the El Paso & Southwestern at Bisbee, Ariz.

L. A. STOLL, formerly general foreman of the locomotive department, has been appointed assistant superintendent of shops in charge of the locomotive department of the Chicago, Burlington & Quincy, Aurora, Ill.

BEN FRANKLIN TUNE, machinist of the Nashville, Chattanooga & St. Louis, has been appointed gang boss at Nashville, Tenn., to succeed A. H. Corbett, resigned to go into business.

J. S. TYLER, shop foreman on the Chicago & North Western at Casper, Wyo., has resigned to go into business.

A. WATT, locomotive foreman of the Grand Trunk Pacific, has been appointed general foreman at Prince Rupert, B. C.

PURCHASING AND STOREKEEPING

G. W. ALEXANDER, storekeeper of the Central of Georgia at Cedartown, Ga., has been transferred to Savannah, Ga.

M. J. POWER has been appointed general storekeeper of the Canadian Pacific lines east of Fort William, Ont., with office at Montreal, Que., succeeding J. H. Callaghan, deceased.

B. H. ROTUREAU, storekeeper of the Central of Georgia, at Savannah, Ga., has been transferred to Macon, Ga.

ELLIOTT S. WORTHAM, assistant to the vice-president and purchasing agent of the Chicago & Alton at Chicago, has been appointed manager of purchases and supplies, with office at Chicago, and the office of purchasing agent has been abolished.

OBITUARY

WILLIAM A. DERBY, acting engineer of tests of the Chicago, Burlington & Quincy, with office at Aurora, Ill., died at the city hospital at Aurora on June 30. Mr. Derby was born October 22, 1872, at Burlington Iowa. He attended the grammar school, high school and Elliott's Business College at Burlington, attended Iowa College at Grinnell, Iowa, for three years, and spent four years at the Armour Institute of Technology at Chicago. He entered the service of the Burlington in July, 1898, in the laboratory at Aurora. In 1903 he was made assistant engineer of tests, and on February 4, 1910, was promoted to acting engineer of tests.

NEW SHOPS

ARIZONA EASTERN.—Bids will soon be called for on a 20-stall engine house and repair shops at Phoenix, Ariz.

ATCHISON, TOPEKA & SANTA FE.—A contract has been awarded for the building of an engine house at Marceline, Mo.

BALTIMORE & OHIO.—The final plans for the improvements at Garrett, Ind., include a new engine house of 18 stalls, which is to be 100 ft. in depth, and an oil house 34 ft. x 50 ft. Both buildings will be constructed of brick with composition roofs. The company has also let a contract for a cinder pit 150 ft. long, wide enough to admit engines on two parallel tracks. In addition there will be a gravity coaling station having a storage capacity of 8,000 tons, from which engines can take coal on two tracks. A sand house will be constructed having a capacity of 500 tons, and there will also be two concrete inspection pits 300 ft. long. The improvements, including track changes, will cost in the neighborhood of \$200,000.

BINGHAM & GARFIELD.—A five-stall engine house, car repair shop and coaling station are being built at Magna, Utah.

CANADIAN PACIFIC.—Plans are being prepared for a 10-stall engine house at Grand Forks, B. C.

CHICAGO & ALTON.—Plans are being made to erect new shops at Bloomington, Ill., at an estimated cost of \$35,000.

CHICAGO, MILWAUKEE & ST. PAUL.—The construction of a 26-stall engine house has been begun at Perry, Iowa.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—A new engine house will be built at Cairo, Ill., at a cost of \$20,000. A contract has also been placed for a new machine shop at Springfield, Ohio.

GRAND TRUNK.—A 25-stall engine house, with provision for an addition of 10 extra stalls, and repair shops will be built at Prescott, Ont. The total cost of the improvements will be about \$150,000.

MICHIGAN CENTRAL.—A contract has been placed with George B. Swift & Company, Chicago, for a new engine house at Bay City, Mich., to cost \$200,000. The construction of the car shops is also about ready to be started.

NEW YORK, NEW HAVEN & HARTFORD.—A contract has been awarded for the construction of a new brick locomotive shop at Readville, Mass.

SOUTHERN PACIFIC.—This road is preparing to begin work on an enlargement of its shops at Houston, Tex., to cost approximately \$400,000. The new buildings will include a boiler and blacksmith shop, 120 ft. x 310 ft.; a lumber shed, 70 ft. x 240 ft.; machine and erecting shop, 130 ft. x 310 ft.; a new power house, an oil house and a sand house.

WABASH.—The receivers of this road have been authorized to issue certificates to the amount of \$500,000 for new locomotive shops at Decatur, Ill., which will eventually cost \$750,000. These will be the main shops of the system. A new engine terminal will also be built at Delray, Mich.

LOCOMOTIVES AND CARS IN THE UNITED STATES.—The Interstate Commerce Commission has issued statistics for the fiscal year ended June 30, 1911, which show that 61,327 locomotives were in service at that time, an increase of 2,380 over the previous year. Of the total number 14,301 were classified as passenger; 36,405 as freight; 9,324 as switching, and 1,297 were unclassified. The total number of cars of all classes was 2,359,335, or 69,004 more than the previous year. This equipment was divided as follows: 49,818 passenger cars; 2,195,511 freight cars, and 114,006 special company cars.

SUPPLY TRADE NOTES

The Holcomb Steel Company, Syracuse, N. Y., has opened a sales office at 95 Liberty street, New York.

The Moore Patent Car Company, St. Paul, Minn., has moved its main office to the Germania Life building.

The New Castle Steel & Iron Company, New Castle, Del., has been incorporated and will manufacture cars.

Heine Safety Boiler Company, St. Louis, Mo., has moved their Boston office to 10 Post Office Square.

The Grip Nut Company, Chicago, is enlarging its plant at South Whitely, Ind., and is installing ten new 6-spindle nut tapping machines.

The Westinghouse Air Brake Company has removed its Chicago office from room 1545 Railway Exchange building to room 827 in the same building.

The Ralston Steel Car Company, Columbus, Ohio, has almost completed the rebuilding of its plant. The improvements will increase the capacity to 40 cars a day.

The Chicago office of the Jeffrey Manufacturing Company, Cleveland, Ohio, has been moved to the McCormick building. S. S. Shine is the district manager, and will have charge of the Chicago office.

The Hess-Bright Manufacturing Company announces the removal of its office from the corner of Twenty-first street and Fairmount avenue, Philadelphia, Pa., to the corner of Front street and Erie avenue.

Darwin R. James, Jr., has been made president of the Pyrene Manufacturing Company, New York, succeeding P. L. Wilbur, resigned. Edward A. Clapp has been made secretary of the company, succeeding Otto Kelsey, resigned.

The Westinghouse Machine Company, Pittsburgh, Pa., has sent out a circular explaining the use to which the funds, received through the recent sale of the stock of the Electric Properties Company, New York, have been put.

H. F. Wardell has resigned as assistant manager of the Central Locomotive & Car Works, Chicago, to engage in the railway equipment business on his own account, and has opened an office at 302 Railway Exchange building, Chicago.

E. L. Burdick, assistant engineer of tests of the Atchison, Topeka & Santa Fe, with headquarters in Topeka, Kan., has been appointed mechanical engineer of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., with office in that city.

Frank J. Mulcahy, vice-president and general manager of the Crane Valve Company, Bridgeport, Conn., died on August 19 of complications following an operation for appendicitis on August 10. Mr. Mulcahy was born in Cleveland, Ohio, in 1853.

B. N. Osburn has resigned his position as president of the Boss Nut Company, Chicago, to become president and treasurer of the Auto Refrigeration Company of the same city. J. T. Benedict, vice-president of the Boss Nut Company, has been made president, succeeding Mr. Osburn.

F. L. Irwin, chief engineer of the Ralston Steel Car Company, Columbus, Ohio, with office in that city, was killed on August 13 by a train while he was returning in an automobile from the company's plant. Mr. Irwin was 37 years old and had been with the Ralston company since its organization.

The Newcastle Steel & Iron Company, Newcastle, Pa., has been incorporated in Pennsylvania, to make steel cars. A plant is to be built at Newcastle. The incorporators are Edwin N. Ohl,

Andrew B. Berger, W. H. Schroder and E. H. Brainard, all of Pittsburgh, Pa. Edwin Ohl may take an active part in the management of the company.

K. F. Nystrom has been appointed mechanical engineer of the Acme Supply Company, Chicago, with office in that city. Mr. Nystrom was formerly connected with the Southern Pacific as designing engineer for its electric motor cars, and later was assistant mechanical engineer at the St. Charles, Ill., plant of the American Car & Foundry Company.

The Titanium Alloy Manufacturing Company, Pittsburgh, Pa., during 1911, shipped 3835818 lbs. of titanium alloy. This is used in amounts up to 0.6 per cent. in the treatment of steel. Taking 0.4 per cent. as the average percentage of titanium alloy used in the treatment of steel, the amount shipped during 1911 would be sufficient to treat 428,216 gross tons of steel.

On August 1 Robert W. Hunt & Company, Chicago, assumed the inspection of locomotives and passenger equipment for the Illinois Central. In addition to the superintendence of construction at the various locomotive and car plants, the service will include the inspection, at point of manufacture, of various specialties entering into the construction of locomotives.

The Griffin Car Wheel Company, Chicago, will enlarge its plant at Boston, Mass., by building an addition to the foundry, a new machine shop and auxiliary buildings. It is estimated that these additions will increase the present capacity by more than 200 wheels a day. The company will also enlarge its plant at St. Paul, Minn., increasing its capacity by more than 150 wheels a day.

Frederick B. Buss, until recently representative of the National Lock Washer Company, Newark, N. J., with office in Chicago, died in Chicago on August 13. Mr. Buss had been engaged in the railway supply business in Chicago from 1871 until a few months ago, when failing health forced him to relinquish active work, though he retained his connection with the company in an advisory capacity.

J. M. Odenheimer, for the past four years manager of the New York office of the Pennsylvania Flexible Metallic Tubing Company, Philadelphia, Pa., has been appointed sales manager for the B. E. Tilden Company, of Chicago, makers of the Tilden wrecking frogs. Mr. Odenheimer will continue to handle the railway business of the Pennsylvania Flexible Metallic Tubing Company. His headquarters are in the Whitehall Bldg., 17 Battery Place, New York City.

The General Electric Company, Schenectady, N. Y., has declared a 30 per cent. stock dividend in addition to the regular quarterly dividend of 2 per cent. A special meeting of the stockholders was held August 29 to vote on the question of increasing the capital stock from \$80,000,000 to \$105,000,000. After this increase, a dividend of \$30 per share, payable in stock of the company at par, will be paid out of the surplus earnings to stockholders of record, December 31, 1912.

The Vulcan Engineering Sales Company, Chicago, has taken the selling agency for the line of structural and plate working machinery, punches, shears, rolls, bulldozers, etc., made by the Rock River Machine Company, Janesville, Wis. This is in addition to the lines now controlled by the Vulcan company, which include molding machines and foundry equipment made by the Hanna Molding Machine Company, and metal sawing machinery and shop equipment made by the Q. M. S. Company.

The Case Crane & Engineering Company, Columbus, Ohio, has been formed, and has taken over the plant and business of the Case Crane Company. The new company will be under entirely different management than the old, and will have the personal supervision of Paul T. Norton, of the Jeffrey Manufacturing Company, who has been appointed president and general man-

ager. Among the directors and stockholders are: S. P. Bush, president of the Buckeye Steel Castings Company; J. F. Stone, president of the Seagrave Company; J. A. Jeffrey, president of the Jeffrey Manufacturing Company; Col. James Kilbourne, president of the Kilbourne & Jacobs Manufacturing Company; O. A. Miller, president of the Ohio Paper Company; and J. H. Frantz, vice-president of the Columbus Iron & Steel Company.

Charles C. Higgins has opened a Chicago office in the Railway Exchange building for Suffern & Son of New York. It is planned to handle work along production engineering lines, especially for the railroads. Mr. Higgins was born in Aurora, Ill., in 1876. He attended the public schools and high schools in Aurora, and in 1890 was graduated as a mechanical engineer from the University of Minnesota. He served as a special apprentice on the Chicago, Burlington & Quincy, after which he was assistant to the engineer of tests, traveling fireman, roundhouse foreman, and general foreman at different points in Nebraska. In 1907 he went with the American Brake Shoe & Foundry Company as a traveling salesman, and in 1910 he entered the service of the motive power department on the Atchison, Topeka & Santa Fe, and was associated with H. W. Jacobs, assistant superintendent of motive power, from which position he resigned July 1 to enter the service of Suffern & Son.

C. H. Osborn has resigned as assistant superintendent of the car department of the Chicago & North Western to become vice-president of the Mid-Western Car Supply Company, Chicago. Mr. Osborn was born at Westfield, Mass., March 31, 1875, and was graduated from the Sheffield Scientific School, Yale University, in the class of 1895. He entered the employ of the Chicago & North Western in the same year, and after serving as a special apprentice in the mechanical department filled successively the positions of engine house foreman, division foreman, master mechanic, and for the past four years, assistant superintendent of the car department. In going with the Mid-Western Car Supply Company

Mr. Osborn will have charge of the mechanical department and will devote special attention to the development and sale of the one-piece combination body and truck bolster, which was exhibited at the M. C. B. and M. M. conventions at Atlantic City in June.

The B. F. Goodrich Company, Akron, Ohio, has purchased the properties and business of the Diamond Rubber Company, New York, and hereafter the two organizations will be operated as one. The officials of the enlarged company will be as follows: B. G. Work will continue as president; H. E. Raymond will continue as second vice-president and sales manager; C. H. Raymond will continue as secretary; W. A. Means will continue as treasurer; F. A. Hardy, formerly president of the Diamond company, has been made chairman of the board of directors; F. H. Mason, formerly vice-president of the Goodrich company, has been made vice-chairman of the board of directors; A. H. Marks, formerly vice-president and general manager of the Diamond company, has been made first vice-president and general manager; E. C. Shaw, formerly manager of works of the Goodrich company, has been made second vice-president and works manager; W. B. Miller, formerly secretary of the Diamond company, has been made second vice-president and assistant sales manager; G. E. Norwood, formerly assistant treasurer of the Diamond company, has been made assistant treasurer. The Diamond Rubber Company will now operate as the Diamond Sales Division of the B. F. Goodrich Company.

Henry W. Jacobs, who recently resigned as assistant superintendent of motive power of the Santa Fe, has been made president of the Oxneld Railroad Service Company, Chicago.

This company was organized to introduce the use of oxy-acetylene welding on railways. G. H. Pearsall and C. B. Moore, who were recently made vice-presidents of the Jacobs-Shupert U. S. Firebox Company, New York, as noted in the August issue of the *American Engineer*, have also been made vice-president and vice-president and treasurer, respectively, of the Oxneld company. Mr. Jacobs was born in Atchison, Kan., September 28, 1874. At the age of 13 he began his apprenticeship as machinist molder and

structural iron worker in the Seaton Foundry & Machine Company, Atchison. After serving five years with that company, he went to the United States gun shop, Washington, D. C., as machinist. He familiarized himself with the design, construction and performance of marine engines, as for several years he was engaged in testing marine machinery on vessels. He then went to the Sprague Electric Company, New York, and later to the Crocker-Wheeler Company, Ampere, N. J. He was also in the employ of R. Hoe & Company, makers of printing presses and newspaper machinery, as tool designer. In 1899 he was made superintendent of the Vulcan Engineering Company, New York, engaged in general repair work and building stationary and marine machinery. Afterwards he entered railway service as tool foreman of the Chicago, Burlington & Quincy. He held this position at various shops of that road until 1903, when he was made shop demonstrator of the Omaha, Neb., shops of the Union Pacific. Later he was given supervision of shop practices and methods in all the repair shops of that company. In 1904 he was made engineer of shop methods for the Atchison, Topeka & Santa Fe, and in December, 1906, assistant superintendent of motive power, with jurisdiction over the entire system, which position he held until July 1, 1912.



Charles C. Higgins.



Henry W. Jacobs.



C. H. Osborn.

CATALOGS

BLOWERS.—McEwen Bros., Wellsville, N. Y., have issued bulletin No. 2, describing steam blowers. Results of tests are included, as well as price lists and tables of dimensions.

PUMPING BY COMPRESSED AIR.—The Ingersoll-Rand Company, New York, has issued a catalog describing and illustrating the methods of lifting or pumping water by compressed air. Various installations are shown, together with data as to their efficiency and cost of operation.

WHEEL PRESSES.—The Watson-Stillman Company, New York, has issued catalog No. 85, illustrating and describing their hydro-pneumatic wheel presses. These presses are built for belt or motor drive. The catalog also contains a specification table for 60 to 600-ton presses.

ENGINES, FORGING PRESSES AND HEAVY MACHINERY.—The Mesta Machine Company, Pittsburgh, Pa., has issued a 48-page illustrated booklet showing various views of their shops, and of their products, including steam and gas engines, air compressors, forging and bending machines, heavy gears and pulleys.

STORAGE BATTERY TRUCKS.—Home-made tractors using a storage battery and electric motors are being used with great advantage in several railway shops. Trucks of this kind can now also be purchased and a bulletin, No. 13-B, issued by the Jeffrey Manufacturing Company, Columbus, Ohio, illustrates several types furnished by it.

REAMERS.—The Kelly Reamer Company, Cleveland, Ohio, has issued a catalog on adjustable reamers with high speed steel blades. The catalog is well indexed and contains a description of the various types of reamers manufactured by this company and instructions as to how to use them. Price lists are given with each type of reamer described.

STEAM TURBINES.—A folder has been issued by the Kerr Turbine Company, Wellsville, N. Y., describing the Economy steam turbine. This turbine is an improvement over the old style Kerr design, the difference in the two being that the new turbine has a blade and vane construction, which produces a flow of steam parallel to the turbine shaft.

BOLT AND NUT MACHINERY.—One of the most interesting exhibits at the last convention of the Master Mechanics' and Master Car Builders' Associations, was the demonstration of semi-automatic designs of bolt and nut machinery furnished by the National Machinery Company, Tiffin, Ohio. The machines, demonstrated at that time, are illustrated and briefly described in a leaflet just issued by that company.

PRACTICING EFFICIENCY AND KNOWING COSTS.—The Emerson Company, New York, is sending out a brochure under this title which contains a reprint of a letter sent to a New England manufacturer by Harrington Emerson, the president of the company. The argument, presented in an interesting and striking manner, is that system and efficiency are very different things, and that efficiency is by far the more important of the two. In the words of Mr. Emerson, "efficiency is the relation between what is and what ought to be. To determine what actual costs are is a clerical task, but this helps very little if we do not know what the costs ought to be."

ELECTRICAL OPERATION OF RAILWAY SHOPS.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 4959, which is profusely illustrated, showing various electrical installations. The particular points discussed are the independent drive as against the group drive and the alternating current as against the direct current, the conclusion arrived at being that the individual system of drive has in several cases replaced the group system and alternating current is used in preference to the direct current. Illustrations are given of installations in the

Readville repair shops of the New Haven, the Chicago shops of the Rock Island lines, the Huntington shops of the Chesapeake & Ohio, and the Albany shops of the New York Central.

HERRINGBONE GEARS.—With the continued increase in the power and speed of many classes of machinery, the subject of proper gears is continually becoming of greater importance. While within their limitations, there is probably no better arrangement for transferring power than the spur gear, there are serious objections to them in some cases and increased interest and attention is being given to the herringbone gear. These offer advantages in connection with the smoothness of action, noiseless operation, freedom from end play and better results at high speed than any other means of connecting parallel shafts. A complete discussion of the subject with illustrations of the various applications and arrangements of gears of this character will be found in a catalog recently issued by the Earle Gear & Machine Company, Wyoming & Stenton Aves., Philadelphia, Pa.

REFRIGERATOR CARS.—A refrigerating, heating and ventilating system for cars designed to handle perishable products is briefly described and well illustrated in a catalog being issued by the Moore Patent Car Company, St. Paul, Minn. With this system the ice box is located just under the roof at the centre of the car and ducts are provided under the floor and around the sides for stimulating the circulation. For heating, a heater is installed under the floor of the car, and the passages are so arranged that the incoming fresh air is heated and discharged near the top of the car. From here the arrangement of intakes and ducts insure a thorough circulation. A large part of the catalog is given up to letters received from various users of this system of refrigeration and these, combined with the tests, a large number of which are recorded, indicate the success of the Moore system under very difficult conditions.

COLD METAL SAWS.—It is believed that the first metal cold saw cutting off machine made in this country was designed and built by the Newton Machine Tool Works of Philadelphia in 1889. The wonderful progress that has been made in these machines since that date is strikingly indicated by an examination of the ninety-nine pages in catalog No. 47 now being issued by that company. As is pointed out in the catalog, a metal sawing machine is really a milling machine and all the usual practices in the operation of the latter should be observed in the operation of cold saws. This company has kept this fact clearly in mind in the designing of all types of its saws. The catalog illustrates and fully describes special saws for practically every possible purpose, as well as saws for universal use. For all heavy duty saws, the inserted tooth type is adopted, but other classes of blades are also shown. This is probably the most complete collection of illustrations of machines of this character that has ever been issued.

MACHINE TOOL ACCURACY BULLETIN.—Users of machine tools, both large and small, would find it worth while to carefully investigate the methods of manufacture of the builders from whom they contemplate making purchases. A high quality of product is about the cheapest thing that can be purchased in labor saving machines and the user will do well to become acquainted with the quality of the tool even before he makes any investigation as to price. In order to bring before possible purchasers the attention that is being paid to this feature in its shops, the American Tool Works Company, Cincinnati, Ohio, is issuing a bulletin in which are described the methods followed by it in testing the various kinds of machines during the process of manufacture. Illustrations are included which make extensive explanation unnecessary, and although the bulletin contains but 30 pages, it covers a large number of important features on lathes, planers, shapers and drill presses. A perusal of this bulletin will bring to light some features that will be surprising to those who have not made themselves acquainted with the care with which a modern quality machine is built.